

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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No. 6

CONTENTS

- ✓ CALCIFICATION OF THE INTERVERTEBRAL DISKS IN CHILDHOOD.
Frederic N. Silverman, M.D. 801
- ✓ KEROSENE POISONING IN YOUNG CHILDREN.
*Joseph C. Foley, M.D., Nicholas B. Dreyer, M.R.C.S., L.R.C.P.,
A. Bradley Soule, Jr., M.D., and Ephraim Woll, M.D.* 817
- OSTEOMATOSIS (LEONTIASIS OSSEA). HEREDITARY DISEASE OF MEM-
BRANOUS BONE FORMATION ASSOCIATED IN ONE FAMILY WITH
POLYPOSIS OF THE COLON. *Henry P. Plenk, M.S., M.D.,
and Eldon J. Gardner, M.S., Ph.D.* 830
- CHRONIC IDIOPATHIC OSTEOARTHROPATHY. *Theodore E. Keats, Capt., MC,
AUS, and William S. Bagnall, Lieut. Col., MC, USA* 841
- BIOLOGICAL EFFECTIVENESS OF THE HIGH-SPEED ELECTRON BEAM IN MAN.
*Lewis L. Haas, M.D., John S. Laughlin, Ph.D.,
and Roger A. Harvey, M.D.* 845
- RENAL ECHINOCOCCUS DISEASE. *I. R. Berger, M.D.,
and G. T. Cowart, M.D.* 852
- THE ROENTGEN DEMONSTRATION OF CIRRHOSIS OF THE LIVER WITH FATTY
METAMORPHOSIS. REPORT OF A CASE DUE TO CONGENITAL
FIBROCYSTIC DISEASE. *Howard L. Steinbach, M.D.,
Jackson T. Crane, M.D., and Henry B. Bruyn, M.D.* 858
- OPTIMUM DOSAGE STUDIES FOR RADIATION THERAPY OF CARCINOMA OF THE
UTERINE CERVIX. *James F. Nolan, M.D.,
and Lucille DuSault, A.B.* 862
- INTRAVENOUS CHOLEDOCHOGRAPHY WITH A NEW CONTRAST MEDIUM,
"CHOLOGRAFIN." *T. L. Orloff, M.D., D. M. Sklaroff, M.D.,
E. M. Cohn, M.D., and J. Gershon-Cohen, M.D.* 868
- A NEW APPROACH TO THE ULCER PROBLEM: IRRADIATION OF THE
SURGICALLY EXPOSED STOMACH. AN EXPERIMENTAL STUDY.
Matthew Talmadge Moorehead, M.D. 871
- EDITORIAL: SO YOU ARE GOING TO PRESENT A SCIENTIFIC PAPER.
Robert P. Barden, M.D. 875
- ANNOUNCEMENTS AND BOOK REVIEWS. 878
- RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES. 881
- ABSTRACTS OF CURRENT LITERATURE 885
- INDEX TO VOLUME 62 923

RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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Calcification of the Intervertebral Disks in Childhood¹

FREDERIC N. SILVERMAN, M.D.

CALCIFICATION of the intervertebral disks generally has been considered a degenerative disease of adults. Schmorl (19), whose extensive studies on this subject are recognized as fundamental, believed disk calcification to be a degenerative process of no clinical significance. It was described more recently, by de Lorimier (6) only in relation to "senescent spinal osteoarthropathy." Other investigators, however, have discovered radiographically demonstrable calcification of the disks in association with local clinical symptoms (1, 11, 13, 18, 23) and with systemic disease (16).

Calcification of the intervertebral disks is said to be very uncommon in children. Cohen and his associates (4), in 1949, could find only 6 earlier case reports. These included the case of Weens (23) and 5 cases from the foreign literature abstracted in his report. In all of these 6 cases there were clinical signs referable to the areas in which calcification was observed. A similar case, in an eleven-year-old girl, is included in the paper of Lasserre and Phelippot (11). In the second edition of his *Pediatric X-ray Diagnosis* (1950), Caffey (3) states that in adolescence such calcification is exceedingly rare and that it has not been reported in infants. He includes an illustration of calcification in the nucleus pulposus of the third and

fourth thoracic intervertebral disks in an eleven-year-old girl without symptoms.

Within the past five years, we have had the opportunity of reviewing 7 additional cases of intervertebral disk calcification in children. This small series, which practically doubles the number of case reports in the available literature, is presented to demonstrate that relationship to symptoms, as in adults, cannot be clearly defined, and particularly to stimulate additional reports which may permit better evaluation of the condition. It is our belief that calcification of the intervertebral disks is more common in childhood than the few available references in the literature would lead us to believe.

STRUCTURE OF THE INTERVERTEBRAL DISKS

The following description is based on the careful studies of Schmorl (19), Coventry and associates (5), and Peacock (14). The intervertebral disk is a truncated fibrocartilaginous cylinder which varies with age both in anatomical structure and in chemical composition. The anatomical features are illustrated in Figure 1. Before maturity, opposing surfaces of adjacent vertebral bodies are covered by a thin cartilaginous plate. Although relatively smooth on the disk surface, each of these plates is irregularly roughened on its vertebral surface by radially disposed

¹ From the Department of Pediatrics and Radiology, College of Medicine, University of Cincinnati, and from the Department of Roentgenology, Children's Hospital, Cincinnati, Ohio. Presented at the Thirty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 13-18, 1953.

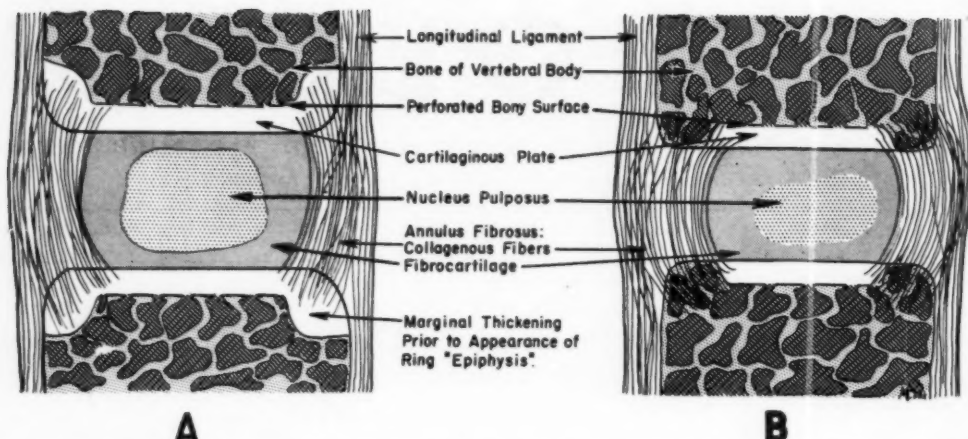


Fig. 1. Diagrammatic representation of the intervertebral disk before appearance (A) and after union (B) of the ring "epiphysis."

ridges which attain their maximal thickness peripherally. Multiple secondary ossification centers make their appearance in this thickened rim about the time of puberty and fuse laterally to form the so-called annular epiphysis. Ultimately, the ring fuses with the body and together with it produces a shallow bony recess containing the cartilaginous plate. Some controversy exists as to whether the plate should be considered part of the vertebral body or part of the intervertebral disk. For the present discussion, this point is immaterial, so long as the anatomical position is understood.

Continuous with opposing cartilaginous plates is a flattened sphere of fibrocartilage; this surrounds the firm, elastic, avascular reticulum which is called the nucleus pulposus. The nucleus pulposus is derived from the primitive notochord, and notochordal cells can be identified within it during the first ten years of life. Surrounding the fibrocartilage, except where it is continuous with the cartilaginous plates, is a dense envelope of collagenous fibers. These are embedded in the peripheral portions of the plates, especially in the thickened margins, so that in the adult they are actually embedded in bone. The fibers arch from the surface of one vertebral body to the opposing surface of the next, with the concavity directed toward the

nucleus pulposus. Some of the fibers arch over the rim and become attached to the vertebral body, much as Sharpey's fibers enter the cortex of a long bone. The outer fibers unite with fibers of the vertebral ligaments, which are strongly attached to vertebral bodies. The collagenous envelope and the fibrocartilaginous sphere comprise the annulus fibrosus. With the passage of time, the demarcation between the several elements becomes less clearly defined; cartilage cells extend into the nucleus pulposus, which loses its vertical height and migrates from its original central position, possibly as a result of differential vertebral body growth. In the dorsal region and in the upper lumbar region, the migration is posterior; in the cervical region, it tends to be anterior.

Electron microscope studies (21) show that the nucleus pulposus is a three-dimensional lattice gel system, composed of a dense network of poorly differentiated collagenous fibrils and an amorphous interfibrillar substance. The latter disappears with aging and "unmasks" the fibers, thus decreasing the water-holding properties. As age advances, the nucleus pulposus loses its identity, merging with the annulus fibrosus, and ultimately clefts appear within the disk, simulating an actual joint cavity. Throughout all this period, the nucleus pulposus remains avascular, ap-

parently receiving its nutrition by diffusion from the rich network of vessels on the vertebral side of the cartilaginous plates. The bony plates of vertebral bodies proper are perforated, permitting intimate contact between the vascular structures of the marrow and the cartilaginous disks. Some vascular structures have been described in the collagenous portion of the annulus fibrosus, but only in the posterior segments.

The intervertebral disks serve as shock absorbers, cushioning and damping the jars and jolts arising from motion. The nucleus pulposus is continually under pressure, as is clearly demonstrated by the manner in which it bulges when the disk is sectioned.

CALCIFICATION OF THE INTERVERTEBRAL DISKS

Calcification can occur in the nucleus pulposus or the annulus fibrosus, or in both. It also occurs in the cartilaginous plates, but this type has not been observed in children. Careful anatomical and radiologic studies by Rathcke (17), Barsony and Koppenstein (1), Lasserre and Phelippot (11), and others indicate that at all ages calcification in the annulus fibrosus is much more common than in the nucleus pulposus. In the intervertebral disks as elsewhere in the body, calcification may be present but radiographically invisible. The relative frequency with which it is found in anatomical studies is much greater than would be expected from reports of radiographic investigations. Rathcke found calcification in 4 of 14 spines from individuals from birth to twenty-nine years of age; in all it was restricted to the annulus fibrosus. The actual ages of those with calcification is not stated. Fifty-six of 72 spines from persons between thirty and fifty-nine years showed calcification; in 3 of the 56, the nucleus pulposus was involved. Of 114 spines from individuals sixty years old and over, 95 showed intervertebral disk calcification, and in 10 of the 95, the calcification was in the nucleus pulposus. Rathcke found calcification in all disks from C-6 to L-5, with the excep-

tion of L-3 and L-4. The highest incidence was in the mid-dorsal region, and frequency decreased gradually to the level of T-2 cephalad and T-10 caudad; beyond these levels a sharp drop in occurrence was noted.

Many theories have been formulated concerning the etiology of calcification of the nucleus pulposus and of the annulus fibrosus. It is now generally accepted that calcification in the annulus fibrosus probably represents a degenerative change and is of little or no clinical significance except in the instance of ochronosis. Calcification of the nucleus pulposus, however, is held by many, and particularly by Weens (23), to represent a different condition, which occurs in childhood, is associated with clinical symptoms, and is of a transient nature. It has been suggested by some that nuclear calcifications are traumatic in origin (7). Others (10) have supported an infectious origin. Nicotra (12) observed calcification in association with back pain after an influenza-like illness and coined the term "infectious chondro-neuritis" to describe his concept of the condition. Contributors of the case reports quoted in Weens' paper expressed the opinion that the calcification might be the result of metastatic infectious disease. Some investigators (2) claim to have demonstrated that in childhood the disk is supplied by blood vessels, which undergo a slow process of degeneration terminating in the third decade. It would thus be closely connected with the general circulation and open to invasion by any disease propagated by the blood stream. Others (5, 14) are agreed upon the absence of a vascular supply. Nevertheless, if nutriment and metabolites can reach the disks by diffusion (*e.g.*, the appearance and disappearance of calcification), there is no reason why noxious agents cannot do the same.

Generalized metabolic disease, particularly alkaptonuric ochronosis, can produce generalized calcification of the intervertebral disks (16); it would not be expected to cause isolated calcification of the type

described by most authors and present in our patients. In alkaptonuric ochronosis, a defect in the metabolism of tyrosine and phenylalanine results in the incomplete breakdown product, homogentisic acid, which appears in abnormal amounts in the blood and urine. This compound is precipitated or deposited particularly in avascular tissue (20), such as cartilage, where certain chemical changes result in the development of a black pigment. The term ochronosis was invented by Virchow because, on microscopic section, the pigment granules appear yellow (ochre) rather than black. The deposits of pigment ultimately cause degeneration of cartilage, with clinical and roentgenologic manifestations of arthritis and metastatic calcification. In the spine, a uniform calcification throughout all intervertebral disks is observed and is considered pathognomonic of the disease (16). The arthritic manifestations of alkaptonuric ochronosis occur only after the condition has been active over a period of many years, usually appearing clinically in the fourth and fifth decades (8), and therefore would not be associated with the calcifications in childhood.

Sandström (18) attempted to divide calcifications of soft tissues into two groups, on the basis of their permanence or impermanence. Permanent calcifications are known to occur in various cartilaginous tissues, including the cartilaginous plates of the intervertebral disks and the fibrocartilage of the annulus fibrosus, as well as in other body tissues, *e.g.*, costal cartilages, larynx, trachea, blood vessels, lungs, and lymph nodes, and in calcifying disorders of connective tissue. Impermanent calcifications, apart from those induced by toxic doses of vitamin D, were ascribed to an inflammatory reaction originally named peritendinitis calcarea, and subsequently myotendinitis calcarea. This disease is characterized by local inflammatory reaction and calcification in connective tissue around tendons and joints and in adjacent muscles, accompanied by local pain and occasionally by

constitutional symptoms. Sandström called attention to the morphologic resemblance between the structure of the nucleus pulposus and the tissue around tendons. The central portion of the fibrocartilage of the annulus fibrosus is similar, and therefore may also contain impermanent calcifications.

Calcifications comparable to those described by Weens, and those to be described in this paper, are reported by Sandström as occurring in adults, with clinical symptoms referable to the region involved; serial examinations showed a tendency for the calcifications to disappear. Sandström was of the opinion that calcifications within the peripheral part of the disk were probably of a permanent nature and of no clinical significance, while centrally located disk calcifications were impermanent and justified a diagnosis of myotendinitis calcarea.

CASE REPORTS

CASE I: L. D., colored female, was born at term, July 12, 1943, after an uncomplicated pregnancy and spontaneous labor at home. Her birth weight was slightly over 7 pounds. The neonatal condition was good, without cyanosis, convulsions, jaundice, or other abnormality. A right clubfoot deformity and congenital atresia of the left external auditory canal, with a deformed hypoplastic external ear, were noted at birth. The nutritional history was good, and no excess vitamin D had been administered. Development was satisfactory. The clubfoot was treated by wedging casts and manipulation.

At the child's first medical clinic examination, Dec. 13, 1943 (five months), an umbilical hernia was noted, and a loud continuous murmur was heard in the second left interspace. A diagnosis of patency of the ductus arteriosus was made. By January 1944 (six months) the clubfoot had been satisfactorily corrected, but manipulation was continued for another six months, and a shoe with wedges was worn for another year. No clinical signs or symptoms referable to the spine were noted at any time. The umbilical hernia was repaired when the patient was three years old, and the patent ductus arteriosus was ligated in June 1948 at the age of five years. At the present time (October 1953) the child is clinically well except for persistent deformity of the ear. Laboratory studies have not been remarkable. The urine is negative for homogentisic acid.

Roentgenographic Examination (description limited to the vertebral column): Calcification of the intervertebral disks was discovered in 1948, when the patient was five years of age, during the course of in-

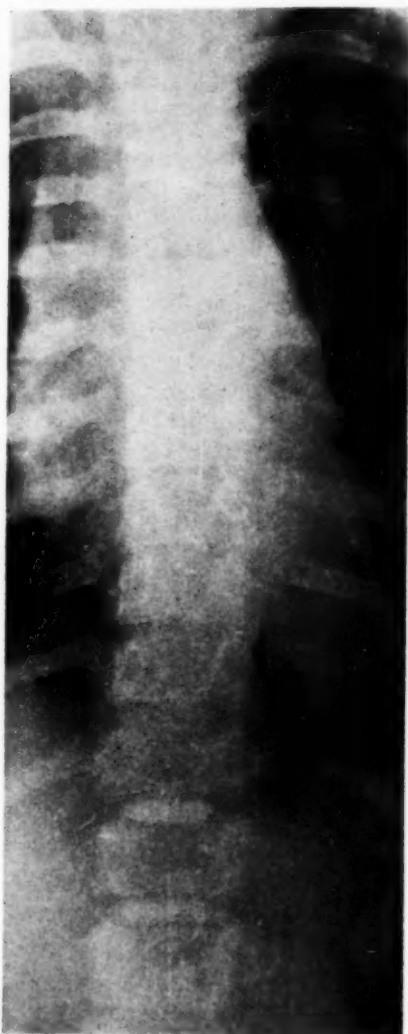


Fig. 2. Case I. L. D., colored female, 5 years. Asymptomatic calcification of 4th and 12th dorsal and 1st lumbar intervertebral disks. Patient had patency of the ductus arteriosus, congenital atresia of left external auditory canal, clubfoot deformity, and cervical spina bifida occulta.

vestigation prior to cardiac surgery (Fig. 2). Films of the chest were available back to the age of five months, when the cardiac abnormality was first discovered. Calcification was noted in the fourth and twelfth thoracic disks and in the first lumbar disk in a review of films taken at thirteen months of age. The process was well advanced and may well have been present at five-months but invisible because of a technic which did not permit evaluation of the spine. The configuration of the calcification at



Fig. 3. Case I. L. D., 9 1/2 years. Change in shape of calcification in 4th intervertebral disk. No symptoms. Calcification was practically gone nine months later. Note invagination of vertebral bodies adjacent to calcification, and spina bifida occulta of C-7.

thirteen months was identical with that at five years (Fig. 2). It took the form of a flattened diamond in the fourth intervertebral disk as viewed in the frontal projection, with the highest vertical diameter in the center, sloping off toward either side. In the twelfth thoracic disk the calcification had a relatively flat inferior border and slightly curved superior margin and extended almost the entire width of the disk; the first lumbar calcification was comparable in shape and extended the full width of the adjacent vertebral bodies. Lateral projections indicated that its major vertical diameter was posterior at the lower thoracic and upper lumbar levels, but approximately in the center of the disk at the upper thoracic level. Re-examination at six years and nine months showed no change in the fourth thoracic or the first lumbar calcification. That in the twelfth dorsal disk, however, was slightly diminished, and there was a suggestion of beginning calcification in the eleventh dorsal disk. At nine and a half years, the calcification in the fourth dorsal disk was lost peripherally and persisted as a central rounded

density (Fig. 3). Multiple small flocculent densities were present posteriorly in the eleventh dorsal disk. In the twelfth dorsal disk the calcification had almost completely disappeared, but the first lumbar calcification was unchanged (Fig. 4). In the most recent examination (October 1953), at ten and one quarter years, the fourth thoracic disk calcification

CASE II: B. K., white female, was born April 15, 1942, weighing 6 pounds and 4 ounces. Birth history and nutritional history were normal, and the child did not receive excessive amounts of Vitamin D. The mother was a diabetic and had several insulin shocks during the last trimester of pregnancy. The usual childhood diseases had been mild, with the ex-

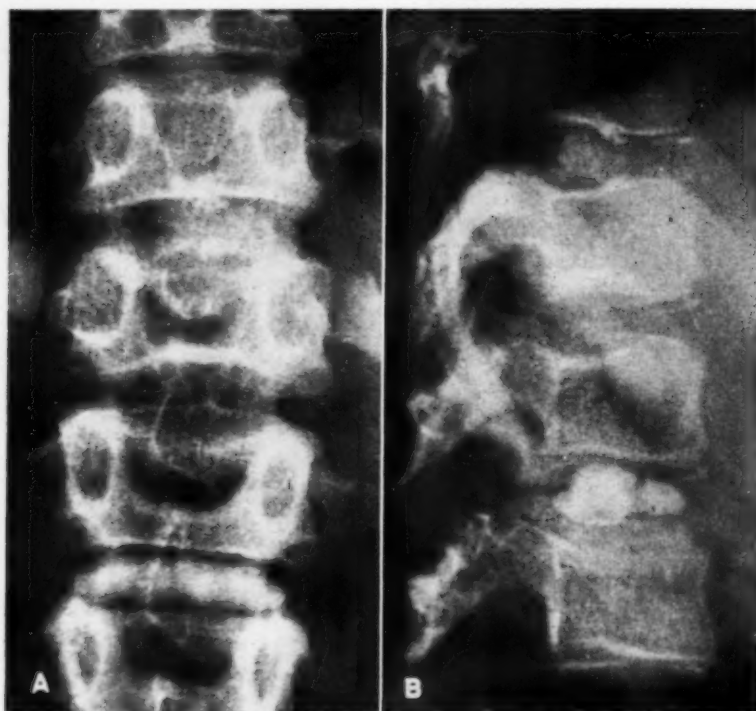


Fig. 4. Case I. L. D., 9 1/2 years. A. Persistence of calcification in disk at L-1, disappearance in T-12, and appearance at T-11, all unaccompanied by symptoms. Compare with Figure 2. Note persistent invagination of vertebral bodies T-12 and L-1. B. Lateral projection.

was almost gone. Calcification had increased in the eleventh disk and had practically disappeared in the twelfth. No change was recognized in the first lumbar disk. In all the areas affected, it has been clear that both central and peripheral calcification was present. The calcification seemed to disappear first in the peripheral areas and finally in the central areas, and there is a suggestion that its appearance follows the reverse pattern.

In all areas where calcification was found, the adjacent surfaces of vertebral bodies were invaginated. The invagination was related to the site of maximal vertical diameter of the calcification, presumably the site of the nucleus pulposus, and persisted after calcification had disappeared. Invagination was also observed, to a lesser degree, in areas of the spinal column where no disk calcification could be identified. A spina bifida occulta of the seventh cervical neural arch was present.

ception of German measles at two years of age, following which strabismus was noted. A heart murmur was first heard at the age of seven days, but occasioned no concern until the child was approximately eight years old, at which time easy fatigability and dyspnea on exertion supervened. Physical examination revealed characteristic signs of patency of the ductus arteriosus in a fairly thin child who was otherwise well. The vertebral curves were stated to be normal, and the posture was not remarkable. Roentgen examination for evaluation of the cardiac malformation supported the diagnosis of patency of the ductus arteriosus and identified a right aortic arch. At eight years of age, the patent ductus arteriosus was ligated and divided, and the incomplete vascular ring released. Clinical symptoms of dyspnea and fatigability disappeared, and in the first three years after surgery the child gained 20 pounds and grew 5 1/2 inches.

Roentgenographic Examination (description limited to the vertebral column): Calcification of the disks in the second, third, and seventh intervertebral spaces was first recognized during the follow-up examination immediately after surgery (Fig. 5). Review of the first film, taken six months earlier, showed that the calcification had been present at

Although no symptoms had ever been related to the spine, it was noted, at the last examination in the medical clinic, in April 1953, that the child had complained of pain in the right axilla for approximately one month, especially when the right arm was elevated. Slight pain in the axilla was produced when the shoulder was abducted from 90 to 180 degrees.



Fig. 5. Case II. B. K., white female. A. At 8 years. Asymptomatic calcification of intervertebral disks at levels T-2, T-3, and T-7. B. Lateral projection at 11 years, 10 months. Both illustrations reproduced from routine chest films. Patient had patency of the ductus arteriosus.

that time but had passed unnoted. The calcifications were all located posteriorly in the intervertebral disk; the vertical diameter was greatest posteriorly as viewed in lateral projection, and in the mid-line as viewed in frontal projection. In this latter view, the calcification extended approximately two-thirds across the lateral width of the disks. The borders of adjacent vertebral bodies were invaginated at the sites of maximal thickness, to such an extent in the third dorsal vertebra as to present, in frontal projection, the picture of "fish vertebra." There were no areas of invagination elsewhere in the spine.

No local lesion was found. At that time it was not appreciated that the dermatomes corresponded exactly to the second and third thoracic levels. (Attempts are being made to bring the patient back for re-examination and to obtain further clinical information concerning symptoms at the level of the second and third thoracic dermatomes.)

CASE III: J. C., white male, born Jan. 15, 1946, had a normal birth and nutritional history. His birth weight was 5 pounds, 7 ounces; vitamin D was not given in excess. His development had been normal except that he was small. At six months of

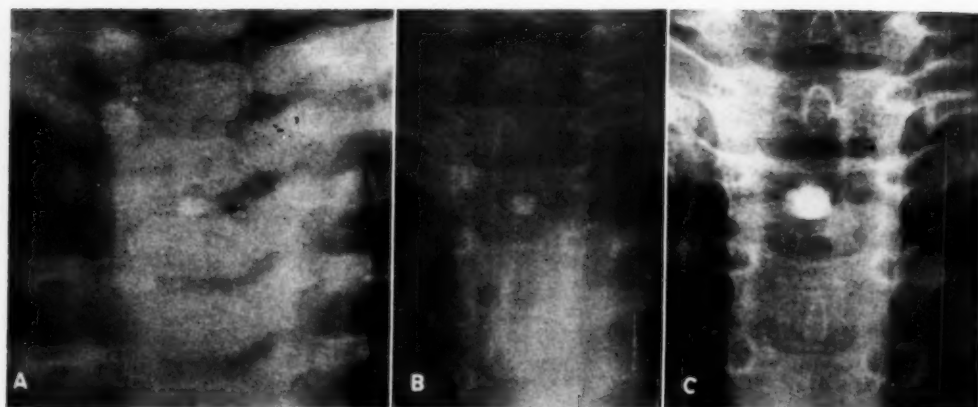


Fig. 6. Case III. J. C., white male. Asymptomatic calcification of 2nd dorsal intervertebral disk. A. At 6 months. B. At 4 years, 10 months. C. At 7 years, 9 months. Recurrent respiratory infections and small stature.

age he had pertussis complicated by severe pneumonia, and respiratory symptoms recurred with considerable frequency for the next two or three years. The child was first admitted to the hospital because of the pertussis and pneumonia, and remained for two weeks. He was again hospitalized for a comparable length of time at ten months of age because of bronchopneumonia. At that time it was noticed that he persisted in lying on his abdomen, often with his head retracted. The neck, however, was supple. Shotty cervical lymph nodes were present. There were brown elevated plaques on the soles of both feet; the mother believed that these were of recent origin, and they disappeared spontaneously nine days after admission to the hospital. On penicillin the clinical improvement was prompt and satisfactory. Laboratory studies were not remarkable. Follow-up examinations to October 1953 showed that the child was still small but without respiratory complaints. At no time had the stools been foul smelling or bulky or otherwise indicative of fibrocystic disease of the pancreas. The urine was negative for homogentisic acid.

Roentgenographic Examination: At the first examination, pneumonic consolidation of a patchy distribution was observed in the left upper hemithorax. The lungs cleared before the child left the hospital, but at the second admission, at ten months of age, a recurrence of shadows in this region was noted. During the initial hospital admission, the patient received a total of 234 r (in air) through a 10-cm. round anterior portal over the left upper hemithorax for the pneumonia. Treatment factors were 200 kv.p., 20 ma., 50 cm. S.T.D., 0.5 mm. Cu and 1.0 mm. Al filter. The radiation was administered in three equal doses on alternate days. The initial inflammatory reaction in the lungs had cleared by 1950, and since then there have been no radiographic features to suggest fibrocystic disease of the pancreas.

Intervertebral disk calcification was first noted in 1950, when the patient was four years and ten months of age (Fig. 6B). This was recognized in a frontal projection as a rounded shadow of increased density located in the mid-line in the interspace between T-2 and T-3. Review of the films taken at six months of age, because of the pulmonary inflammatory reaction, permitted definite identification of this shadow at the same level (Fig. 6A). The calcification had increased in size as the patient had grown and maintained its relationship to the intervertebral space and to the adjacent bodies. Films taken in October 1953, at seven years and nine months (Fig. 6C), demonstrated no change in the relative size of the calcification, although it had increased absolutely commensurate with the general increase in somatic proportions. A lateral projection indicated that it lay anteriorly in the intervertebral space. No significant invagination of adjacent vertebral plates could be identified. Roentgen examination of the patient's brother failed to reveal any similar calcification, and the remainder of the patient's spine showed no abnormalities. The first ribs on both sides were hypoplastic, the left much more so than the right.

CASE IV: L. H., white female, was born Nov. 11, 1945, after an eight-and-a-half-month pregnancy; she weighed 4 pounds and 15 ounces at birth. Her development was retarded, but her nutritional history was normal. She had mild mumps and pertussis in May of 1949 at the age of three and a half years. A physician treated her with glutamic acid for an unspecified period.

The child was admitted to the hospital for evaluation of mental retardation. She was well nourished and well developed but had a dull expression. No other abnormalities were noted. The laboratory findings on admission were remarkable only with respect to eosinophil counts of 41 and 49 per cent on

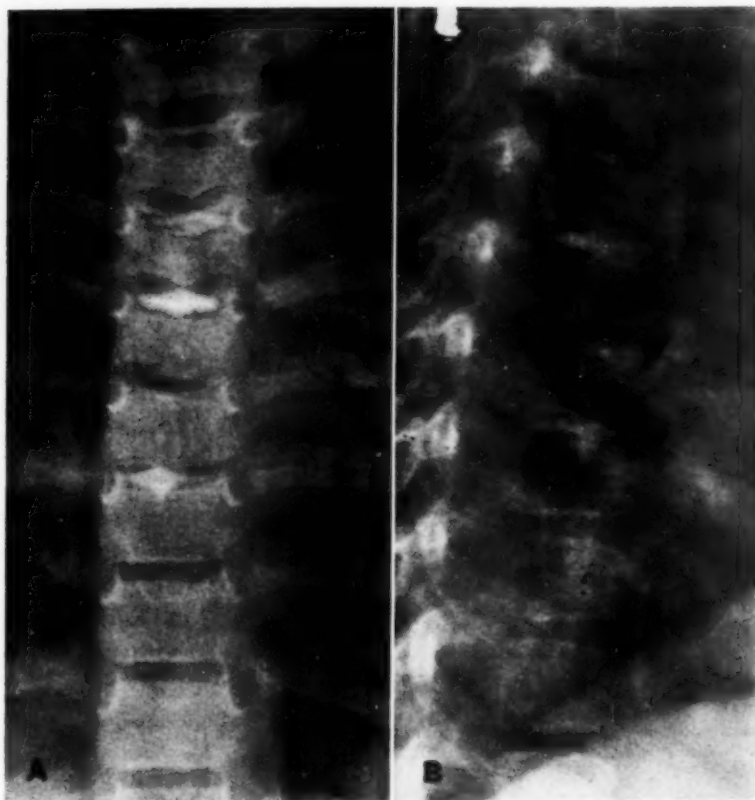


Fig. 7. Case IV. L. H., white female, 4 years, 4 months. A. Asymptomatic calcification of 3rd, 4th, and 6th dorsal intervertebral disks. B. Lateral projection. Similar appearance at 7 years, 11 months. Prematurity and mental retardation.

two occasions, associated with total white cell counts of 35,150 and 17,800 per cu. mm., respectively. Blood counts of the parents showed no eosinophilia or other abnormality. A Trichina skin test was negative. PPD "B" and histoplasmin skin tests were negative. The clinical impression was mental retardation due to unknown cause, possibly neonatal anoxia.

Röntgenographic Examination: In March 1950, films of the skull were normal. No abnormalities were noted in the heart or lungs. Flattened diamond-shaped areas of calcification were present in the intervertebral disks at the third, fourth, and sixth dorsal levels (Fig. 7). The calcification was most marked at the fourth and least at the third level. In lateral and frontal projections, it was seen to occupy approximately two-thirds of the diameter of the disk. No significant invagination of adjacent vertebral borders could be identified. Re-examination in October 1953, at the age of eight, demonstrated persistence of all calcifications. The fourth vertebral body was narrowed vertically in its posterior two thirds by the still most prominent fourth disk calcification. The urine was negative both for

homogentisic acid and phenylpyruvic acid. White blood cells numbered 8,200 per cubic millimeter, with 10 per cent eosinophilic leukocytes.

CASE V (courtesy of Dr. A. J. Kravtin and Dr. George Epps, Columbus, Ga.): A six-year-old white girl was seen in the Crippled Children's Clinic, with round-back deformity. Her birth history was not known, and her past history indicated only a mild attack of glomerulonephritis at five years of age. Because of a suspicion of ochronosis, based on the finding of intervertebral disk calcification in roentgenograms, the child was admitted to the hospital. Laboratory examinations were entirely non-contributory. The urine was negative for homogentisic acid.

Röntgenographic Examination: Dense calcification, like a flattened diamond in shape, was seen in the fifth, eighth, and tenth dorsal intervertebral disks and the first lumbar intervertebral disk, in a frontal projection. In the lateral view, a fifth calcified disk was identified at the third thoracic level (Fig. 8). The calcifications tended to have their maximal vertical height centrally as seen in the

C-7 (Fig. 9). In the lateral view, multiple flocculent areas of increased density extended the entire length of the disk; in the anteroposterior projection, they could be identified only in the middle third of the transverse width of the disk. Re-examination fifteen months later showed no evidence of calcification or abnormality of the vertebrae. Further history at that time revealed that the clinical symptoms of fever, sore throat, and stiff neck recurred three or four months after discharge from the hospital. The fever lasted for only a day or two; the stiff neck persisted for a week and apparently responded to massage. No roentgen study was made during the second episode. The child was subsequently well.

Sept. 30, 1953 (Fig. 10B), demonstrated marked clearing of the calcification. The clearing appeared to have taken place to the greatest degree in the anterior portion, where only a few flocculent densities could be recognized. A small persistent area of density occupied the middle third of the intervertebral disk space as viewed in lateral projection; this was closer to the sixth cervical vertebral body than the fifth. The bodies were unchanged.

COMMENT

In Table I, the clinical and roentgenographic data concerning the 15 cases of

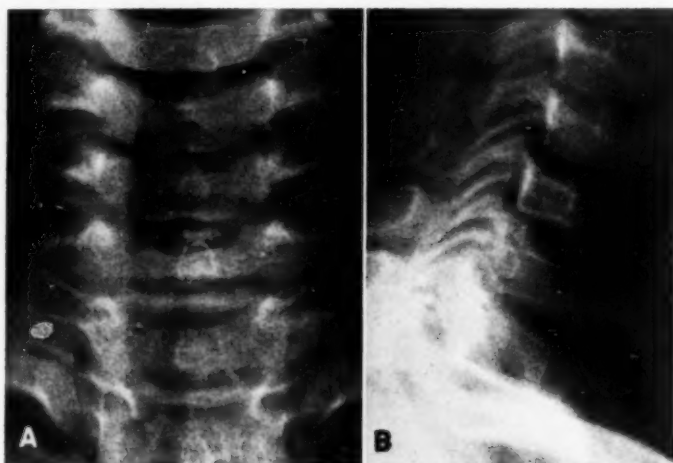


Fig. 9. Case VI. J. B., white male, 7 years, 10 months. A. Faint calcification in 6th cervical intervertebral disk in course of febrile illness with stiff neck. B. Lateral projection. Calcification no longer visible in films taken fifteen months later.

CASE VII (courtesy of Dr. George F. Jones, Lancaster, Ohio): A white male, age 11 years, had an acute unexplained torticollis on May 14, 1953, the upper portion of the neck and head being tilted to the right. There was no history of sore throat or antecedent trauma. Details of the earlier history were not available. Treatment was limited to local dry heat, and symptoms disappeared within two or three days. Hematologic studies were not done, but urine examination five months after the acute episode was negative for homogentisic acid.

Roentgenographic Examination: On May 14, 1953, a lateral view of the cervical spine (Fig. 10A) demonstrated an irregular calcification in the interspace between C-5 and C-6. The calcification was mostly anterior, where it achieved its maximal vertical height, and tapered posteriorly. It extended from the anterior margin of the vertebral column to the posterior quarter of the intervertebral disk. There were no recognizable abnormalities in the opposing vertebral surfaces. A repeat examination,

intervertebral disk calcification in childhood for which clinical histories are available are summarized. One is tempted to divide the patients into two distinct groups: one with acute symptoms of pain and fever and transient calcification, most common in the cervical region, and one with "permanent" calcification, generally thoracic or lumbar, unassociated with recognizable symptoms. There are, however, certain observations which do not permit this clear-cut distinction. The second group exhibits features which Weens (23) believed differentiated the condition in adults from that in children. Sandström (18) described similar clinical manifestations and transient calcification in adults, with involvement of the dorsal

TABLE I: FIFTEEN CASES OF INTERVERTEBRAL DISK CALCIFICATION IN CHILDREN

Author and Date	Age and Sex	Clinical Data	Site	Duration	Comment
1. R. Cohen <i>et al.</i> , 1949	6 yr. F	Abdominal pain for 3 yrs. Calcification incidental finding	T-12	Unknown	Asymptomatic
2. Weens, 1949	5 yr. F	Neck pain for 2 months; acute for 5 days. Temp. 100°. Small cervical nodes. Well in 2 days	C-6	11 months plus. Larger 7 months before episode; change in 12 days during episode; gone 4 months after episode	Eosinophilia (<i>Ascaris</i>) No treatment to neck
3. Baron, 1924*	12 yr. M	Influenza-like disease. Severe backache 10th day. Temp. for 4 days. Well in 4 weeks. Tender dorsolumbar area	T-12 L-1	1 year plus. Larger 4 months after episode, then disappeared	
4. Kohlmann, 1931*	12 yr. M	Sudden backache after calisthenics. Tender upper dorsal spine	T-4	Decrease in 2 months	Back pain disappeared in several weeks
5. Lyon, 1932*	8 yr. M	Sudden neck pain; high temp. Better in 4 days; cured after 12 days	C-6	Decrease in 5 months; gone 8 months after acute episode	
6. von Held, 1934*	10 yr. ?	"Cold" and fever. Pain in neck and shoulder after 1 week. No complaints after 2 months	C-2 C-3 C-5	Nearly disappeared 2½ months after acute illness	Red tonsils with exudate
7. Keyzer, 1939*	2 ¼ yr. M	Sudden neck pain. High temp. Pain decreased over several weeks. Illness with fever for 5 weeks	C-2 C-3 C-4	No change after several months	Hemolytic streptococcus on blood culture
8. Lasserre and Phelippot, 1947	11 yr. M	Pain, left scapula, torticollis, unknown duration. No fever	C-6	Unknown	
9-15. Silverman, 1953					
Case I	13 mo. F	Incidental observation. Patent ductus arteriosus, clubfoot, congenital auditory atresia, and cervical spina bifida	T-4 T-11 T-12 L-1	More than 9 years. Calcification at T-4 and T-12 disappearing at 10 years; T-11 increasing; L-1 unchanged	Urine negative for homogentisic acid
Case II	7½ yr. F	Incidental observation. Patent ductus arteriosus. Right aortic arch	T-2 T-3 T-7	At least 4 years without change	Pain, right axilla for 1 month, 4 years after initial observation
Case III	5 mo. M	Incidental observation. Recurrent respiratory infection	T-2	At least 7 years	Urine negative for homogentisic acid
Case IV	7 yr. F	Incidental observation. Mental retardation	T-3 T-4 T-6	More dense 3½ years later	Urine negative for homogentisic and phenylpyruvic acids
Case V	6 yr. F	"Round back." History of glomerulonephritis. Incidental observation	T-3 T-5 T-8 T-10 L-1	?	Urine negative for homogentisic acid
Case VI	7¾ yr. M	Acute stiff neck. Better in 3-4 days. Well in 6 days. Slight temp.; few cervical nodes	C-6	Completely gone 15 months later	Sore throat 2-3 days before onset
Case VII	11 yr. M	Acute torticollis	C-5	Clearing 6 months later	Urine negative for homogentisic acid

* Cases 3-7 cited by Weens.

and lumbar intervertebral disks. Age factors, therefore, are not entirely valid criteria for evaluating the nature of disk calcification.

Nor is location of real differential significance. It is true that all the children with cervical calcification presented similar complaints, that the calcification was transient, and that cervical calcification was uncommon in the anatomical studies of Rathcke (17). Also, no reports of com-

graphic examination while the neck is held rigid in such cases has led to the erroneous diagnosis of subluxation of the cervical spine. The cause of these episodes is unknown; it has been assumed by many to be "myositis."

The duration of the calcification, when examined critically, is no more helpful than age or location. In Weens' own case, the calcification was larger when the child was asymptomatic, seven months before the

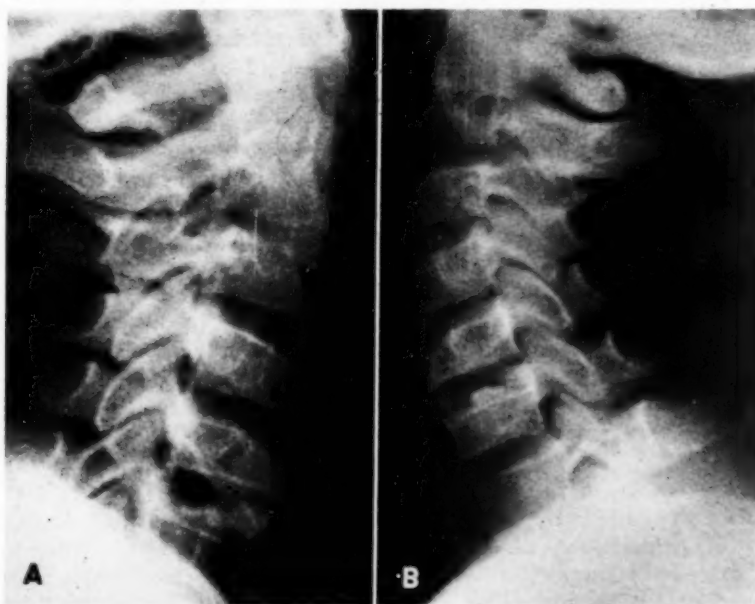


Fig. 10. Case VII (Courtesy of Dr. George F. Jones, Lancaster, Ohio). T. C., white male, 11 years. A. May 1953, during acute attack of torticollis. Calcification in 5th cervical intervertebral disk. B. September 1953. Patient asymptomatic. Calcification has largely disappeared. One dense shadow persists just above the body of C-6.

parable cervical disease in adults were found in a limited review of the literature. But 2 of the 6 cases reviewed by Weens (Baron and Kohlmann) presented the clinical syndrome, though calcification was present in only the thoracic and lumbar regions. These cases are comparable to those of Sandström and Ostapowicz (13) in adults. Clinical manifestations of acute cervical pain and torticollis occur not infrequently in children without calcification in the intervertebral disks. Perhaps a pertinent note of caution is provided by the demonstration (22) that roentgeno-

graphic examination while the neck is held rigid in such cases has led to the erroneous diagnosis of subluxation of the cervical spine. In those cases for which earlier films were available for review after the calcification was first noted, it was observed to persist over periods up to more than nine years. Moreover, appearance of new areas of calcification and disappearance of others was observed in the absence of clinical symptoms (Case I). No definite relationship between a central or peripheral location and the persistence or disappear-

ance of calcification was observed. A definition of "permanent" as used by Sandström would be of interest. The fact that in several of our cases calcification was present but missed on routine inspection of chest films cannot but suggest that such errors occur elsewhere and reflect on reports of both incidence and duration.

The relationship of regional symptoms to intervertebral disk calcification is ill-defined even in instances when changes are observed in serial films. Persistence of asymptomatic calcification with subsequent clinical manifestations and disappearance of the calcification can be likened to observations in calcific bursitis. When, however, we observe long-standing calcification disappear without clinical signs, as in Case I, it becomes difficult to ascribe a cause-and-effect relationship between the calcification and the clinical manifestations or the clinical manifestations and the disappearance of the calcification. The fact that permanent calcification has not yet been described in the cervical region is the only good reason to consider cervical involvement as a separate entity.

What are the causes of intervertebral disk calcification in childhood? In adults, the concept of calcification as a "degenerative" process is supported by the increased incidence with advancing age (17), but the attrition of superannuation cannot apply to childhood. Metabolic defects, as alkaptonuric ochronosis, characteristically require lengthy periods of activity before calcification occurs; those children tested were found negative for alkaptonuria. In addition, metabolic disease should not be restricted to solitary or only a few local areas in its manifestations. Infection is a known cause in so far as tuberculosis is concerned (9); otherwise its role is problematic. The relationship to congenital malformations may bear investigation. Two of our patients had congenital heart disease, patency of the ductus arteriosus in each case. One of these also had a spina bifida occulta in the cervical region (calcification was restricted

to the thoracic and lumbar regions), and a third patient had hypoplastic first ribs. It is not clear whether mental retardation in a fourth patient was congenital or acquired. Possible association with congenital heart disease was explored by a review of the dorsal spine in routine chest films of 125 cases of congenital cardiac malformations, including 50 cases of patency of the ductus arteriosus. No additional instances of calcification of the intervertebral disks were found. Trauma has never been conclusively implicated, nor has it been exonerated. DeSèze and Durieu (7) believed that trauma in an airplane accident resulted in calcification and pain twenty-five years later. The anatomical and physicochemical studies have thus far only confirmed the known fact that the tissues of the disk are calcifiable.

Calcification of the intervertebral disks in childhood must be considered as of unknown significance for the time being. Roentgenographic demonstration of such calcification should not obscure the recognition of identifiable and treatable diseases which may produce the symptoms without relation to the calcification. If other disease is not found, conservative treatment is probably entirely adequate when symptoms are present. When symptoms are absent, no treatment is necessary. Clinical signs and symptoms should be the criterion in this respect, rather than the roentgenographic persistence or disappearance of the calcification. Sandström (18) advocated roentgen therapy. The apparent self-limitation of symptoms, however, makes irradiation in this condition comparable to that in bursitis, in which results have been equally satisfactory with and without a lead filter (15). Since spontaneous resolution of radiologic features and of clinical features does take place, the justification for exposing the vulnerable growing spine of infants and children to radiation may be questioned.

It is hoped that the appearance of additional reports of this condition, or group of conditions, will permit more satisfying conclusions concerning the signifi-

cance of calcification of the intervertebral disks in adults as well as in children.

SUMMARY AND CONCLUSION

Seven new case reports of children with intervertebral disk calcification are offered and are compared with 8 reports available in the literature. A relationship with clinical complaints is not a constant finding and differentiation of possible syndromes on the basis of persistence or disappearance of calcification in relation to symptoms probably is not warranted. The factors accounting for the appearance, persistence, or disappearance of the calcification are unknown. Intensive treatment in the presence of symptoms referable to the level of calcification is not justified. The one fact that persistent calcifications have not been recognized in the cervical levels may permit separation of the group with cervical calcification, neck pain, and transient calcification, from the group with persistent calcification or with disappearing calcification in other regions.

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SUMARIO

Calcificación de los Discos Intervertebrales en la Niñez

Preséntanse 7 casos nuevos de calcificación de los discos intervertebrales en niños, comparándolos con 8 ya descritos en la literatura. Un repaso de la serie com-

binada no permite llegar a conclusiones satisfactorias acerca de la importancia de la dolencia. No hubo asociación constante con síntomas clínicos ni pareció justificada

la diferenciación de posibles síndromes a base de la aparición, persistencia o desaparición de la calcificación en relación con la semiología.

En los adultos, la calcificación de los discos ha sido considerada como proceso degenerativo enlazado con el envejecimiento. En la niñez, han recibido atención las deficiencias metabólicas y los factores infecciosos, pero su papel es problemático.

Cuando existen síntomas imputables a

la zona de la calcificación, el tratamiento conservador resulta con toda probabilidad absolutamente adecuado. De no haber síntomas, no se necesita tratamiento.

El hecho de no haberse reconocido calcificaciones persistentes en los discos cervicales puede permitir el reconocimiento de dos grupos de casos: uno con pasajera calcificación cervical y dolor en el cuello y uno con calcificación persistente o con calcificación que desaparece en otras partes del raquis. Se necesitan más observaciones.

DISCUSSION

Lewis E. Etter, M.D. (Pittsburgh, Penna.): No doubt most of you will agree with the impression gained by Dr. Silverman in his review of the literature that calcifications in intervertebral disks during childhood are uncommon. We have gone along for some years without seeing any, or perhaps I should say not recognizing any. It is certainly true that if one focuses his attention on a particular structure, much more will be picked up than in a casual examination.

Since most of us have absorbed the idea from the work of Schmorl that calcifications in intervertebral disks represent a degenerative process of no clinical significance in the adult, this idea would quite naturally be carried over in one's thinking with reference to their occurrence even in childhood.

It is indeed quite remarkable, as Dr. Silverman has shown it to be, that many of these calcifications spontaneously disappear after a variable period without any definitive treatment. This very mobility of the calcium deposit shows that it is somehow connected—perhaps by diffusion—with the circulatory system, and in that case pos-

sibly may be influenced by inflammatory, infectious, or even traumatic situations.

This brings to mind the transient calcifications all of us see in relation to connective tissue elsewhere in the body, which may exist either with or without local symptoms.

It is encouraging to note that the essayist is unable to establish a positive relationship between the occurrence of disk calcifications and clinical symptoms, although these coincidences were present in several cervical spine cases.

Dr. Silverman was quick to point out that many children have painful necks and torticollis without demonstrable organic changes. Certainly one would not go along with Sandström, who, as recently as 1951, recommended roentgen therapy for what is likely a spontaneously resolving, self-limited, innocuous finding.

All of us will no doubt be more alert to observe such calcifications in the spine and it will then become possible, after a sufficiently large series has been collected, to draw more valid conclusions with respect to association of clinical symptoms and these organic changes.

Kerosene Poisoning in Young Children¹

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KEROSENE IS A derivative of petroleum which includes fractions of relatively low volatility obtained from distillation at temperatures between 200 and 300° C. The purity of the product varies considerably, depending largely upon the point of fractionation and resulting inorganic material.

The incidence of poisoning from kerosene is far higher, and the complications are more serious than is generally realized. This study was made in an area with a population of about 75,000, where kerosene is used extensively for heating and cooking purposes. Over a nine-year period, between 1944 and 1953, 101 children between the ages of eight months and two years were admitted to five hospitals in northwestern Vermont following the ingestion of kerosene. From information received from physicians practicing in this area, it is estimated that between 30 and 40 additional cases were seen in homes or offices but were not hospitalized. Of the patients referred to the hospitals for care, many showed toxic reactions of varying severity and 2 died.

The cases studied in the three Burlington hospitals comprised 2.1 per cent of all admissions of children under the age of two years and 40 per cent of total admissions of children under two years because of general household accidents, barring fractures, bruises, and lacerations, but including poisonings, burns, and foreign bodies. While kerosene poisoning was not a definitely seasonal type of accident, the highest incidence was observed during the Spring.

The interval between the accident and the patient's arrival at the hospital varied from fifteen minutes to twenty-four hours,

with an average of an hour and a half. The estimated amount of kerosene ingested ranged from a mouthful to 3 ounces; in most cases, the amount was unknown but it seems doubtful that 3 ounces was exceeded in any instance.

Length of hospitalization varied from twelve hours to fourteen days, with an average of 2.95 days. With 2 deaths in the series, the mortality rate was 1.9 per cent.

In reviewing the histories of these cases, particularly with regard to the manner in which the kerosene was obtained, many examples of gross carelessness came to light. One child was said to have sniffed kerosene from a 30-gallon drum from which the top was missing; another drank from a coffee can which was used to catch drippings from a leaky fuel line connected with an oil stove; another drank from a can in the woodshed which contained kerosene used for soaking paint brushes, and still another from a cup left on the kitchen table by the mother, who was treating the child for nits. In one case the kerosene was sucked from an open vent pipe of an oil stove, and in another it was taken from a soda bottle which had been left on the kitchen floor. Another child dipped his fingers in a feeder of an oil stove and sucked the kerosene from them for about half an hour, while still another drank from a can of kerosene which was kept on a window sill near the kitchen stove to be used for starting wood fires. From these examples and many others of similar nature, it seems clear that in most instances the children obtained the kerosene because of negligence or ignorance of danger on the part of the parents.

In many instances, the child was found lying beside the container or other source of

¹ From the Departments of Radiology, Pharmacology and Pathology, University of Vermont College of Medicine, Burlington, Vt. Presented at the Thirty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 13-18, 1953.

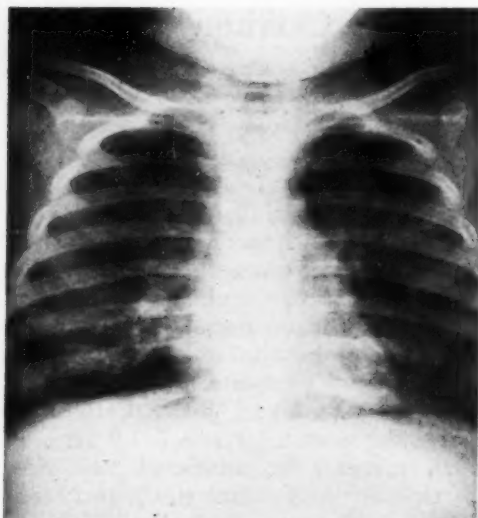


Fig. 1. Earliest radiograph taken after ingestion of kerosene. The patient was a 16-month-old child found coughing and gagging beside a small can containing kerosene; dyspneic but not cyanotic. The film was taken about twenty-five minutes after the accident. Note small patchy areas of cloud-like density in both lower lung fields, more prominent on the right.

kerosene, coughing and choking and with an odor of kerosene on the breath. Many became drowsy and stuporous within about an hour. Six were unconscious when found; all of these ran a toxic course with symptoms of pulmonary damage. Fifty-two per cent of the children vomited either before or soon after arrival at the hospital, 46 per cent were dyspneic, and 24 per cent showed evidence of cyanosis on arrival or within the first six to eight hours after admission. The pulse rate ranged from 80 to 160 per minute, rapid rates being noted in more than half of the patients. Ninety-two per cent had temperature elevations within four to six hours following ingestion or inhalation of the kerosene, the higher temperatures being noted in the cases in which hospitalization was delayed. In most cases there was a gradual return to normal after about forty-eight hours. In several of the more severe cases, the temperature remained high for as long as eight days.

Physical signs in the chest were meager in the majority of cases, but râles, rhonchi

and small areas of dullness to percussion were observed in 26 cases.

An increased leukocyte count, especially neutrophilic, was obtained in 78 per cent of cases. Acetone was present in the urine in many instances in quantity directly proportional to the severity of toxicity. However, since children in this age group are prone to exhibit acetonuria with many types of minor upset, this finding may not be significant.

A diagnosis of pneumonitis was made in 48 cases, all of which showed roentgen changes to be described later. Since 47 children did not have x-ray examinations of the chest, it is possible that some may have had pneumonic changes which were not diagnosed clinically. It appears significant that 69 per cent of the children who vomited either before or after reaching the hospital showed evidence of pneumonitis, while in only 31 per cent of those who did not vomit were pneumonic changes observed. One child (Case IV) was admitted with tracheal obstruction from aspirated vomitus.

Practically all of these children were treated by gastric lavage, with plain water or sodium bicarbonate in weak solution. Some of them vomited during this procedure. Almost all were placed in oxygen tents for twelve to twenty-four hours or until dyspnea and cyanosis had disappeared. Most were given penicillin throughout their hospital stay and were later followed at home by the family physician, with the recommendation that the drug be continued for several days.

ROENTGEN FINDINGS

Roentgen examinations were made of the chests of 54 of the 101 children, either on admission or during their hospital stay. A few patients were studied with serial radiographs taken at one- or two-hour intervals for six to twelve hours and then every twenty-four hours until the lungs were clear or until the child was discharged from the hospital. The findings varied considerably in extent and severity of the lesions, being classified as follows:

	No. of Cases
Group 1: Negative.....	6
Group 2: Minor abnormalities; accentuation of normal markings; patchy densities not exceeding 10 per cent of lung area.....	29
Group 3: Clouding of up to 30 per cent of lung area.....	13
Group 4: Clouding of more than 30 per cent of lung area.....	6

In those cases in which pneumonitis appeared, it developed within a few hours after exposure to the toxic agent. The earliest radiograph taken was made about twenty-five minutes after the child swallowed or aspirated kerosene; this showed small scattered areas of cloud-like density in each lung base. Twenty-four hours later, more extensive confluent clouding was noted in both lower lobes, especially in the basal segments.

In 74 per cent of patients with positive findings, there was involvement of portions of all lobes of both lungs, although the basal segments of the lower lobes showed the greatest change. The right lower lobe was more extensively involved than the left, and the right middle lobe showed involvement almost as frequently as the right lower lobe. In 22 per cent of cases, the changes were limited to the right lung; in only 4 per cent was the left lung alone involved. In a few mild cases, the only finding was a small zone of clouding in the right lower lung field close to the heart. In all but the more severe cases, the apices and antero-lateral portions of the lungs were spared.

In general, the first changes to be noted in radiographs obtained within an hour or two after exposure consisted of multiple, small patchy areas of cloud-like density, more or less circular in shape but with ill-defined margins (Figs. 1, 2, and 3). In most cases, there was little or no alteration from normal in the bronchovascular markings in this stage.

As the process advanced, the individual lesions appeared to enlarge and coalesce. In several of the more severe cases, signs of emphysema appeared in the upper,



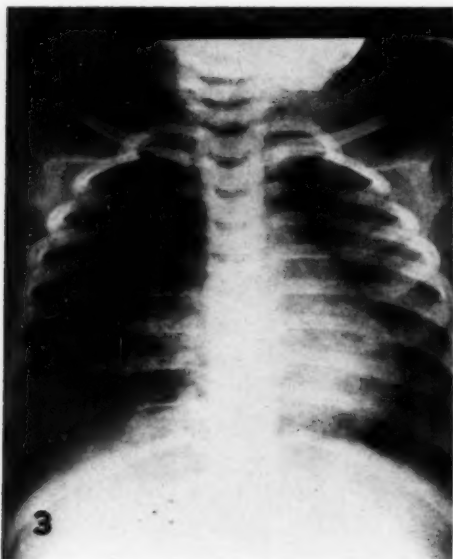
Fig. 2. Radiograph taken one hour after an 11-month-old child drank kerosene. Child was dyspneic and slightly cyanotic. Changes are confined to basal segments of left lower lobe.

outer, and more anterior portions of the lungs.

The peak of involvement was reached in two to eight hours; in no instance was there accentuation of clouding after eight hours, with the possible exception of one fatal case in which a single roentgenogram was taken twenty-four hours after admission.

In the non-fatal cases, resolution was gradual and rather slow, especially with extensive involvement. Usually the lungs were clear or nearly clear within three to five days, although in one instance (Case I) resolution was not complete seven days after the accident. In general, clinical improvement preceded roentgenologic improvement.

Although such complications as empyema, pneumothorax, and pleuritis with and without effusion have been reported by others (4, 5, 6), no such complications were noted in this group. Transitory signs of cerebral depression were observed in a large number of these patients, and one child had a convulsive seizure several hours after swallowing kerosene, following an episode of



Figs. 3 and 4. Case I. Films of 17-month-old child obtained one hour after ingestion of kerosene from drippings of a leaky fuel line. Areas of patchy clouding are present in the basal segments of both lower lobes, in the right middle lobe, and to a lesser extent in the bases of the upper lobes.

The lateral view shows involvement of all lobes.

TABLE I: CLINICAL FINDINGS COMPARED WITH CHEST RADIOLOGIC FINDINGS

Clinical Findings	Group 1	Group 2	Group 3	Group 4
Vomiting	17%	59%	75%	83%
Temperature elevation (average)	99.3°	100.2°	101.8°	101.2°
Dyspnea	33%	22%	39%	100%
Physical findings in chest	8%	31%	85%	100%
Days in hospital (average)	2.3	3.58	4.8	5.8*

* Excluding two fatal cases.

vomiting. Except for vomiting, there were no gastrointestinal symptoms of consequence.

Two children died, thirty hours and three and three-quarters hours following exposure (Cases II and III). All others recovered within several days to two weeks and were discharged well or nearly well. Chest radiographs of a few children who were discharged from the hospital clinically well still showed minor abnormalities of the bronchovascular markings or persistence of small zones of clouding.

As would be expected, there was fairly close correlation of signs and symptoms with extent of pulmonary involvement as

noted on chest radiographs. This is indicated in Table I.

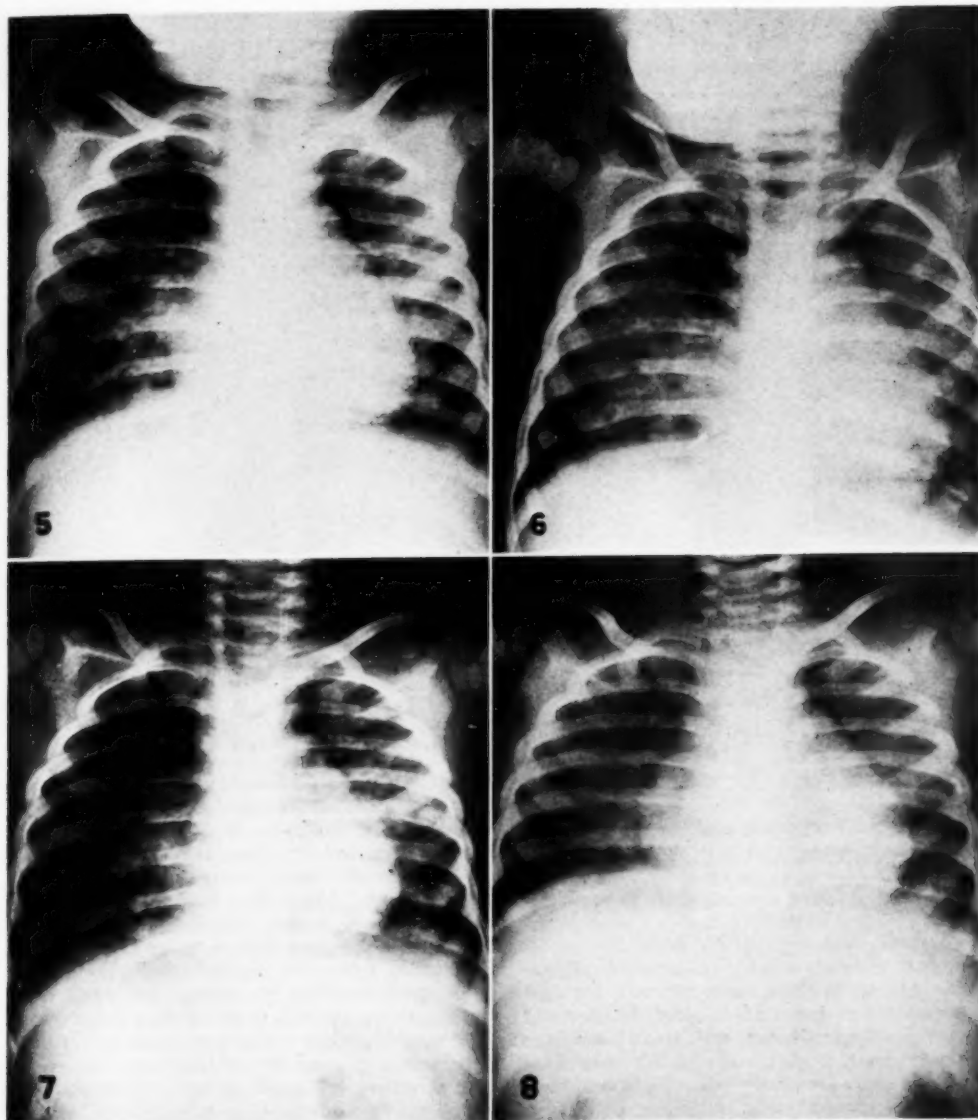
CASE REPORTS

CASE I: A 17-month-old girl was found on the evening of April 14, 1953, at about 6:30 P.M., choking and coughing on the kitchen floor beside an empty cup which had been used to catch drippings from the fuel line of an oil stove. It was the mother's impression that the cup had been about half full when last seen. There was kerosene on the child's face and clothing, and her skin was bluish in color. She vomited several times and appeared drowsy.

The child was rushed by car to the Accident Ward of the Mary Fletcher Hospital, where she was admitted an estimated forty-five minutes after the accident. Gastric lavage was performed immediately, without additional vomiting. Digested food mixed with kerosene was recovered. Chest radiographs (Figs. 3 and 4) taken within fifteen minutes of admission showed small patchy areas of clouding scattered through the lower two-thirds of both lung fields. Though these were principally in the medial portions of the lungs, there was obvious involvement of portions of all lobes.

At this time, the blood pressure was 90/50; pulse 120; respirations 36; rectal temperature 98.4°; blood count normal.

The child was still drowsy, but her color was nearly normal. Respirations were of the grunting type. The lungs were clear to auscultation and percussion except for scattered rhonchi, especially at the left



Figs. 5-8. Case I

Fig. 5. Two hours after the accident. Lesions are spreading and becoming confluent. Slight emphysema in right upper lobe.

Fig. 6. Three hours after the accident. The pneumonic process is at its peak. Respirations more labored. Child placed in oxygen.

Fig. 7. Twelve-hour examination. Marked clinical improvement, with absence of dyspnea and cyanosis; temperature 100°; slight regression of lesions noted radiographically.

Fig. 8. Thirty-six-hour examination, showing continued clearing. There is still slight emphysema evident in the peripheral portions of the right lung.

base. Penicillin, 400,000 units, was administered intramuscularly.

Breathing improved and cyanosis disappeared within an hour after admission. A few hours later, the child grew restless, and respiration became

labored. She was placed in an oxygen tent, and after several hours showed sufficient improvement that she was removed. There was slight temperature elevation (about 100°) for twenty-four hours, but all symptoms rapidly regressed and no further

treatment was required. The patient was discharged from the hospital forty-eight hours after admission and was followed for several weeks by home visits. Gantrisin, 2.0 gm. daily for five days, was prescribed. Recovery was uneventful and no residual symptoms or physical findings of consequence were observed.

During the hospital stay of this patient, chest radiographs were taken at hourly intervals for six hours and then at six-hour intervals for the remainder of the twenty-four hours. Repeat examinations were also made at thirty-six hours and seven days after the accident (Figs. 3-9).



Fig. 9. Case I. Seven days after the accident. There is persistence of small patchy areas of density in the right lower lung field, although the child has remained clinically well.

The peak of involvement, as observed roentgenographically, was at three hours following the accident. At this time, there was noted confluence of zones of clouding in the right middle and lower lobes and in the basal segments of the left lower lobe. There were also a few smaller, more nodular appearing lesions in the peripheral portions of all lobes.

During the next fifteen hours, very little change was demonstrable, although a slight degree of emphysema appeared on both sides, especially in the right upper lobe. At the twenty-four-hour examination, the extent of clouding had diminished by at least 50 per cent; at thirty-six hours only a few small patchy areas of clouding remained in the peripheral regions and at the right base. The seven-day examination showed persistence of several small patchy areas of density in the medial basal segment of the right lower lobe. Shortly after this, the family moved to another state and the child was lost to follow-up, although information received from relatives indicates that she has remained well.

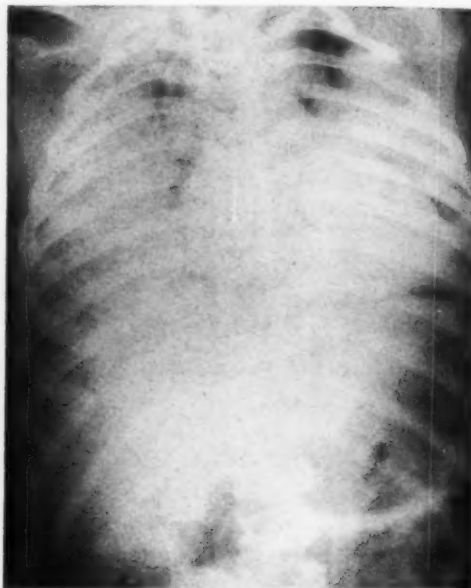
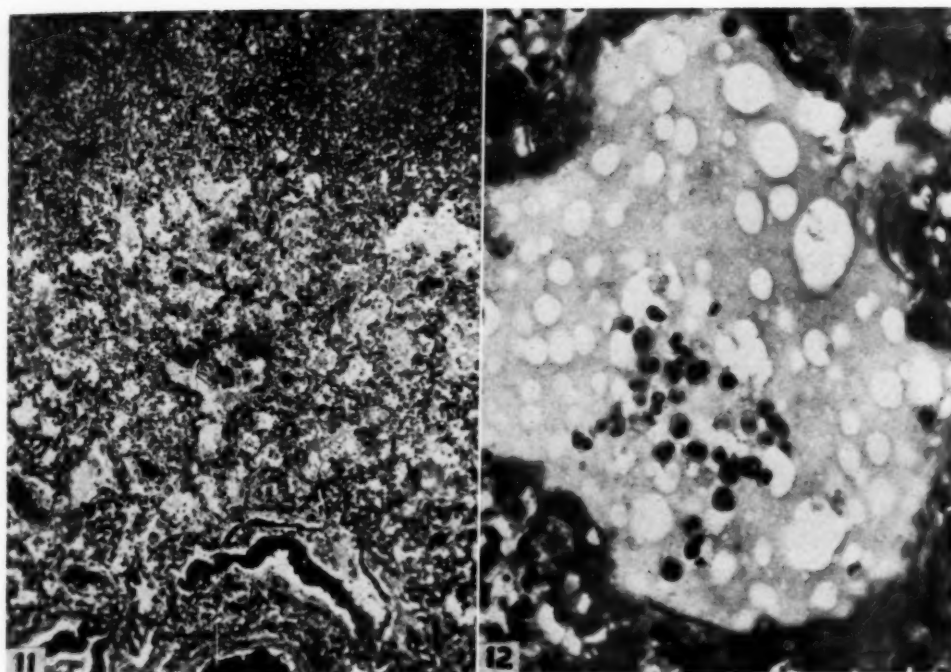


Fig. 10. Case II. Radiograph taken twenty-four hours after the child drank an unknown amount of kerosene. Cyanosis and severe dyspnea. Gastric lavage was accompanied by vomiting. Death six hours later.

CASE II: A well developed and well nourished 19-month-old white male infant was admitted to the Mary Fletcher Hospital on May 25, 1946. About an hour prior to admission, he was said to have drunk an unknown amount of kerosene from a can that was used to catch the drippings from a fuel line leading to the kitchen stove. At admission, the child was moderately cyanotic and drowsy but was not unconscious. Temperature was 98.8°, and respirations were slow, shallow, and jerky. The chest was clear to auscultation and percussion, and the remainder of the physical examination was essentially negative. Immediate gastric lavage was performed and some oily material was recovered. This procedure was accompanied by vomiting.

The child's condition grew rapidly worse. Four hours after admission, the rectal temperature had risen to 103°, respirations were 60 per minute, and fine crackling râles were audible over the left lung. On the following morning, the respiratory rate was 72, and cyanosis, which had diminished in an oxygen tent, again deepened. The CO₂-combining power equaled 28 volumes per cent. Death ensued thirty hours after ingestion of kerosene.

An anteroposterior chest radiograph taken twenty-four hours after admission (Fig. 10) showed almost complete consolidation of both lungs, with only small segments of the apices and right middle lobe and lateral basal segment of the left lower lobe still containing air.



Figs. 11 and 12. Case II. Sections of the lungs show a severe necrotizing bronchitis and bronchopneumonia. Note the hyaline membranes in the alveoli. Fig. 12 is an enlarged detail showing vacuolated amorphous material within the alveolus and hyaline material applied to the lining.

At postmortem examination, both lungs appeared airless except for small areas of crepitation in the apices and in the lateral basal segments of the lower lobes. The lungs were dark purplish-red in color and cut with a meaty sensation. No excess fluid was noted in pleural, pericardial, or peritoneal cavities, and the serous membranes were of normal appearance. All other viscera appeared normal; the cranium was not opened.

Histologic examination of the lungs revealed a marked and uniform inflammatory reaction. The bronchi and bronchioles showed a severe necrotizing process with desquamation of mucous membranes and presence of a dense amorphous detritus in the lumens (Fig. 11). Fibrinoid necrosis involved the peribronchial connective tissue and extended into the alveolar ducts to a lesser extent. Most of the alveoli were filled with a thin, flaky exudate which was quite dense in some areas, especially when lining the alveolar walls. Cells filling the alveoli were chiefly mononuclears, with occasional neutrophils (Fig. 12). Numerous areas of necrosis were noted in both lungs. The blood vessels were well preserved.

Sections of the kidneys showed no visible abnormalities in glomeruli or blood vessels. The capillaries of the medulla were congested, but no hemorrhages were found. The cells of the convoluted tubules showed mild degenerative changes,

with cloudy swelling, but these findings were not pronounced.

In the spleen the normal architecture was maintained, but many polymorphonuclear cells were present in the pulp, with an appearance suggestive of an acute toxic splenitis.

Sections of the liver showed congestive changes, with displacement of the sinusoidal linings away from the liver cords. The appearance suggested edema secondary to circulatory collapse.

Sections of stomach and intestine showed no changes of note. The mucosa appeared intact throughout. There were no evident abnormalities in sections of heart muscle, thymus, and peribronchial lymph nodes.

CASE III: The second fatality occurred in a 15-month-old female child who was admitted to the Mary Fletcher Hospital on April 10, 1944, after having drunk an unknown amount of kerosene an hour and a half earlier. The infant had been sitting on the floor with her twin sister, and both were pulling on a can containing kerosene which was used to light the kitchen stove. The mother's attention was attracted by the screaming and coughing of one of the children and she noted that the can was empty. The child was brought immediately to the hospital and upon arrival was cyanotic and dyspneic. She was coughing and gagging and was raising a bloody,

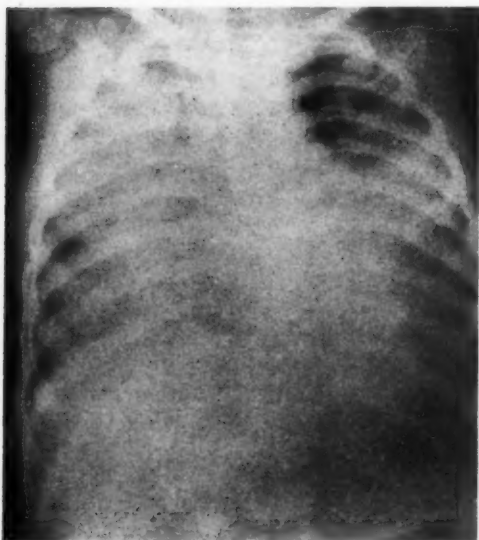


Fig. 13. Case III. Chest radiograph of a 15-month-old child taken three hours after drinking an unknown amount of kerosene. Child was found coughing and gagging; cyanotic, dyspneic, and semicomatose. Death three-quarters of an hour later.

frothy sputum. Her temperature was 102.2°, pulse 80, respirations 150. There was dullness to percussion over both bases and râles were present in both lungs. The child was placed immediately in an oxygen tent and for a few minutes showed temporary improvement, with lessening of cyanosis and dyspnea. About half an hour later, however, she became semicomatose, with shallow, rapid respirations. During the next hour, cyanosis became intense, the respiratory rate increased, and breath sounds were markedly decreased. Death occurred two and a quarter hours after admission and about three and three-quarters hours after the accident. Permission for an autopsy was denied.

An anteroposterior chest radiograph taken one and one-half hours after admission to the hospital (Fig. 13) showed extensive confluent areas of density throughout both lungs, with only the apical posterior segment of the left upper lobe, the extreme apex of the right upper lobe, and portions of the lateral basal segments of the lower lobes containing air.

CASE IV: A rather unusual case was that of a 20-month-old white male who was admitted to the Mary Fletcher Hospital on Feb. 28, 1946, in respiratory distress. The child had been dipping his fingers into the top of the feeder to an oil stove and sucking them for about half an hour. When the mother found him, he was lying on the floor in a semiconscious condition; he was moderately dyspneic and had an ashen appearance. The child was taken to the hospital immediately, arriving

about one hour after being found. At this time he was comatose and had frequent paroxysms of coughing. An odor of kerosene was noted on his breath. The expiratory phase of each respiration was prolonged, and the thorax appeared to be continuously expanded. The lungs were hyperresonant to percussion, and bronchovesicular sounds were elicited over both.

Immediately after admission, the patient was examined fluoroscopically and an anteroposterior radiograph was taken of the chest. The diaphragms on both sides were low in position and showed marked limitation in respiratory excursion. The lungs were grossly over-aerated and very little change in radiolucence or in apparent lung volume was noted between inspiration and expiration. The ribs flared widely, and the chondral ends were elevated. It was apparent that there was laryngeal or tracheal obstruction.

The child was taken immediately to the operating room and a bronchoscope was passed without anesthesia. A considerable amount of material was blown forcibly through the instrument, and as it passed the vocal cords the airway became clear. Examination of the tracheobronchial tree revealed no solid foreign material but considerable liquid secretion, the conclusion being that gastric contents had been aspirated during vomiting. The child was returned to his room breathing more easily, with good color but still comatose. He recovered rapidly and became conscious within an hour. At no time during his hospitalization did he show clinical or x-ray evidence of pneumonitis, and he was discharged on the sixth day.

Recently, an attempt was made to follow up as many patients as possible and 30 of them returned for examination. In 20 of the number, chest x-ray examinations had been done at the time of the original hospital admission. A history was taken as to pulmonary complaints since the accident. The parents of more than half of this group stated that the children had had frequent bouts of respiratory infection of rather long duration. Several had had persistent cough, and 3 pneumonia.

Chest radiographs were taken of all children. Only 1 showed what were felt to be definite abnormalities, with prominence of bronchovascular markings in the basal segments of the right lower lobe suggestive of bronchiectasis. Nine other children showed equivocal minor prominence of markings in the lower lung fields; 20 were definitely negative. From these findings, it was, of course, impossible to

establish the presence of residual damage due to kerosene ingestion, although it seems quite possible that such may be present.

The problem of kerosene toxicity has been studied in recent years by a number of workers. The largest series of cases to date was collected in Louisiana by Bologna and Woody (1), who presented 252 cases in 1948. Heacock (5), in 1949, reported 156 cases from Tennessee, and in 1936 Farabaugh (3) presented 120 cases, with 5 deaths, from Minnesota. In 1953, Gershon-Cohen, Bringhurst and Byrne (4) published an excellent review of the literature and added 4 new cases.

A certain amount of experimental work has been done in the past in an attempt to study the pathogenesis of kerosene intoxication. In 1933, Waring (8) reported 25 cases of kerosene poisoning in children and described experimental work done on dogs. He introduced kerosene by tube into the stomach in one group of animals and into the trachea in a second group, in an attempt to determine whether the pulmonary changes were the result of aspiration of kerosene or of absorption from the gastrointestinal tract with hematogenous transfer. He observed no ill effects when kerosene was introduced into the stomach; radiographs of the chest were negative and kerosene was passed by rectum within two days. When kerosene was introduced by trachea, however, the animals had convulsions almost immediately; their temperatures soon became elevated; respiratory rates were increased, and radiographs of the chest showed abnormal shadows in the lungs. Death supervened rapidly.

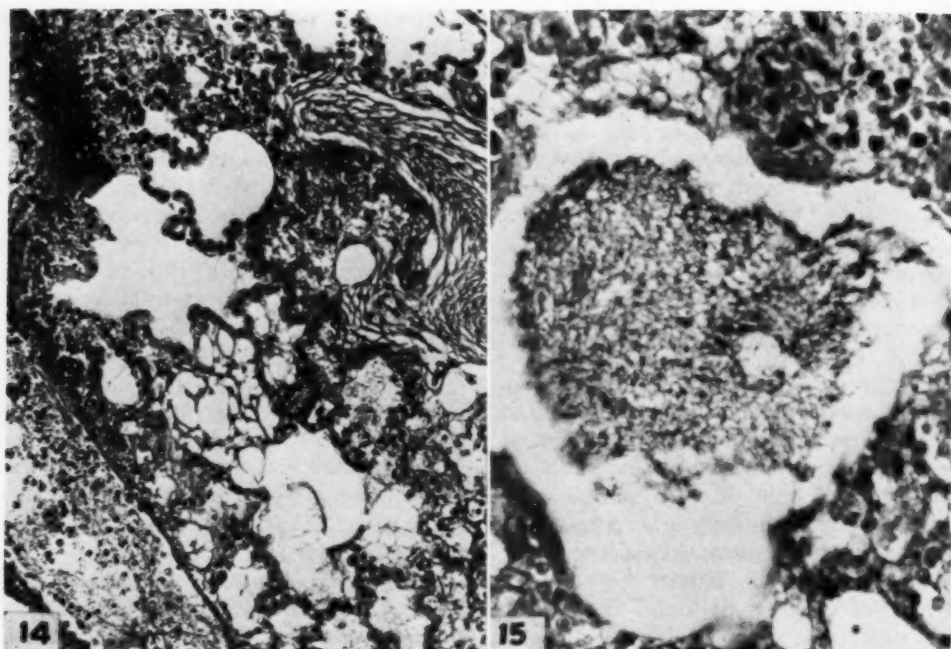
Similar results were obtained by Lesser and co-workers (6) in 1943, in a series of experiments on rabbits. When small quantities (0.75 to 2.0 c.c.) of kerosene were introduced intratracheally, pulmonary lesions developed in all animals with great rapidity, but of those receiving kerosene by stomach tube, none showed toxic manifestations.

Somewhat contradictory results were reported by Deichmann and associates (2) in 1944. They felt, on the basis of experimental work on rabbits, that poisoning was due not only to aspiration but also to absorption from the alimentary tract with hematogenous transfer. Of a group of animals which received 36 c.c. of kerosene per kilogram, administered by tube into the stomach, 60 per cent died in from two to ten days. Similar results were obtained following intravenous and intraperitoneal injections. At autopsy, it was noted that the changes produced in the lungs were similar, regardless of the route of administration. A serosanguineous exudate was noted on cut sections of the lungs; microscopic examination showed evidence of damage to the walls of the pulmonary vessels.

In 1950, Reed and co-workers (7) published a preliminary report of work done on rabbits with findings that were not in agreement with those of Deichmann. No evidence of pulmonary damage could be found in rabbits receiving kerosene orally. It was concluded that the pulmonary changes were the result either of primary aspiration or of aspiration secondary to regurgitation or vomiting.

In view of the conflicting results reviewed above, it was our opinion that additional experimental studies should be carried out to determine the effects of kerosene introduced into the respiratory and alimentary tracts, with special precautions to exclude any possibility of aspiration into the tracheobronchial tree in the gastrointestinal experiments. Even though there is doubt, due to the somewhat unusual anatomic separation of alimentary and respiratory tracts in rabbits, that kerosene introduced into the stomach can be regurgitated and aspirated into the lungs, steps were taken to eliminate such a possibility.

Under urethane basal narcosis, the esophagus of each animal was exposed and ligated. Through an esophageal incision distal to the ligature, a tube was introduced and kerosene, in quantities



Figs. 14 and 15. Necrotizing bronchopneumonia in a rabbit given kerosene intratracheally. Note the amorphous material in a bronchus and in the alveoli. Fig. 15 is an enlarged detail, showing intra-alveolar content, exudate, and hyaline membrane.

varying between 25 and 50 c.c./kg., was slowly instilled into the stomach. As the tube was withdrawn, the esophagus was ligated distal to the incision.

Ten rabbits comprised this series. The immediate effects in all cases were those of moderate toxicity, reduced activity, and stupor greater than that produced by the anesthetic agent. The animals were sacrificed at intervals varying from eight to forty-eight hours after administration of kerosene and were autopsied immediately. All showed intense congestion of the brain, but the lungs were entirely free of abnormalities, gross or microscopic, and no changes could be detected in the viscera. The small bowel was often found to be distended with pools of kerosene, but there was no appreciable injurious effect on the gastric or intestinal mucosa. Microscopic examination of the viscera revealed no evidence of oil droplets outside of the lumen of the alimentary tract. The usual fat stains failed to show any oil droplets.

In a second series of experiments, 4 animals were given kerosene by stomach tube without ligation of the esophagus, 2 animals receiving 25 c.c./kg. and 2 receiving 50 c.c./kg. Two animals, representing the smaller and larger doses, were sacrificed at the end of one week, and the other 2 at the end of two weeks. None of these animals showed any appreciable gross or microscopic abnormality in any of the viscera.

In another experiment, 10 rabbits were used to study the effects of intratracheal injection of kerosene. Following local injection of novocaine, the trachea was exposed and between 1 and 3 c.c. of kerosene were introduced by hypodermic needle inserted directly into the trachea. All animals became dyspneic and irritable almost immediately and after about thirty minutes became drowsy. Three of the animals died within twenty-four hours and the other 7 were sacrificed at intervals of twenty-four to forty-eight hours. The

findings in all cases were quite similar to those observed in Case II, described above.

The lungs, both grossly and microscopically, were seen to be the site of a severe, hemorrhagic, necrotizing bronchopneumonia, with so-called "asphyxial membranes" lining the alveoli (Fig. 14). Many of the alveoli were lined by hyaline membranes, while the alveolar spaces contained an amorphous purple material with numerous vacuoles demonstrable in hematoxylin-eosin preparations (Fig. 15). The trachea, bronchi, and bronchioles showed the presence of some frothy fluid, not blood-stained except in one instance, but the fluid seemed insufficient to interfere with the airway. In all cases, the right ventricle was greatly dilated and the left ventricle was contracted. It seemed apparent, therefore, that the cyanosis and respiratory failure were the result of insufficient interchange of gases within the alveoli, largely due to the presence of the "asphyxial membranes."

One animal received small instillations of kerosene at intervals of several days over a period of six weeks. When this animal was sacrificed, there were noted at autopsy several communicating lung abscesses which apparently originated in bronchi and then involved the adjacent parenchyma. At this time lipid was demonstrated readily. It is doubtful, however, whether kerosene is phagocytosed.

The effects on blood pressure and respiration following the intratracheal injection of kerosene were studied in a group of cats. When 0.1 c.c. of kerosene per kilogram of body weight was injected, the blood pressure usually rose immediately for about one minute, probably from reflex stimulation. Several additional injections were made at ten-minute intervals; each injection was followed by a slight rise in blood pressure, but as each successive injection was made, the rise became less marked. The general trend in blood-pressure levels between injections was downward, however. There was an initial slowing of the pulse, later followed by a

more rapid rate. Cyanosis increased gradually and became extreme shortly before death. The cyanosis was apparently the result of accumulation of large amounts of reduced oxyhemoglobin; in none of the experiments was methemoglobin detected.

Respirations increased slightly in rate but diminished in depth until cyanosis became extreme, when there was a further increase in rate. Breathing then ceased, but without evidence of circulatory collapse. Artificial respiration was instituted, and the blood pressure rose considerably for a short time, probably from the effects of epinephrine liberated as a result of the anoxia. The blood pressure then fell gradually to zero, and the animals died.

When larger doses of kerosene (0.5 c.c./kg.) were administered intratracheally at two-hour intervals, there was an immediate rise in blood pressure, but the subsequent downward trend noted with smaller doses was not as evident. Eventually, however, respiration failed before circulation.

In both groups of animals, the venous pressure showed little change except near the end, when it rose by 15 to 25 mm. of water and then fell as respiratory failure set in.

In a few instances, a small catheter was inserted into the trachea and suction was applied; this resulted in withdrawal of only small amounts of viscid fluid (0.25–0.5 c.c.) but failed to relieve the respiratory distress.

From these findings, it is concluded that in kerosene poisoning there are two major effects of pathological importance: (1) a violently irritating effect on the alveolar walls of the lungs, with rapid development of a chemical bronchopneumonia which prevents the proper interchange of gases, with resulting respiratory failure if the process is sufficiently widespread; (2) a depressing effect on the brain, resulting from absorption of toxic material from the alimentary tract and possibly also from the respiratory tract.

It seems apparent from these studies that the ingestion of kerosene in the doses

studied is not ordinarily associated with pulmonary damage unless the substance is aspirated; in the absence of aspiration, the only major toxic effect is on the central nervous system. It is apparent, however, that when kerosene is introduced in even very small doses into the larynx or trachea it is rapidly and highly toxic from its injurious effects upon the alveolar walls. It also is probable that, in most cases in which pulmonary complications develop, they do so either from inhalation at the time of the accident or from aspiration of gastric contents during vomiting or during lavage. The evidence indicating that pulmonary damage is produced by aspiration of kerosene rather than by absorption from the alimentary tract and hematogenous transfer is further supported by the distribution of lesions within the lungs of children following exposure to kerosene. The predilection for the basal segments of the lower lobes and the relative absence of changes in the apices and anterolateral portions of the lungs is consistent with our knowledge of aspiration of other foreign agents and is difficult, if not impossible, to explain on the basis of blood-borne toxins.

It also seems probable that, in order to produce dangerous toxic and depressing effects upon the central nervous system, amounts of kerosene in excess of that usually ingested by young children must be taken, or there must be mixed with it other toxic agents which are more readily absorbed from the gastrointestinal tract than components of ordinary varieties of kerosene itself. This casts some doubt upon the desirability of performing gastric lavage in the average case, because of the grave danger of aspiration in the course of treatment.

If it is felt that gastric lavage is indicated in an individual case, it is our impression that it should probably be done only after introduction of an intratracheal tube with balloon inflated to isolate completely the respiratory tract distal to the balloon. With such a tube in place, it is possible to irrigate the bronchial tree gently with

small amounts of normal saline and also to give thorough gastric lavage without danger of aspiration. Oxygen therapy and penicillin and other antibiotics to control secondary infection are of proved benefit. Prophylactic measures aimed toward education of the public regarding the dangers of kerosene poisoning are of the utmost importance.

SUMMARY

Kerosene poisoning is a relatively common accident occurring in children between the ages of eight months and two years, especially in areas where kerosene is used for cooking and other household purposes. The major effect, apparently produced by aspiration either of kerosene itself or of gastric contents during vomiting or gastric lavage, consists of a rapidly developing bronchopneumonia with "asphyxial membranes" which, when sufficiently marked, may lead to respiratory failure and death. Depression of the higher cerebral centers may occur from absorption of toxic fractions of kerosene or of impurities within it, probably from the stomach and intestinal tract. If pneumonia develops, it is usually bilateral and may be widely disseminated; it reaches its peak within two to eight hours following exposure, with gradual regression after this time.

Due to the highly toxic effects of even small quantities of kerosene introduced intratracheally, it seems apparent that in most cases gastric lavage should not be done at all or, if done, should be performed only after introduction of an intratracheal tube with balloon inflated. The public should be educated regarding the grave dangers to young children from drinking or aspirating kerosene.

NOTE: The authors are indebted to members of the Medical Staffs of the Mary Fletcher Hospital and Bishop deGoesbriand Hospital in Burlington, Vt., the Fanny Allen Hospital in Winooski Park, Vt., and the Kerbs Memorial Hospital and St. Albans Hospital in St. Albans, Vt., for use of clinical material in this study.

Mary Fletcher Hospital,
Burlington, Vt.

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SUMARIO

El Envenenamiento por Queroseno en los Niños Pequeños

El envenenamiento por petróleo o queroseno es un accidente relativamente común en los niños de ocho meses a dos años de edad, sobre todo en las zonas donde emplean dicha sustancia para cocinar y para otros fines domésticos. El efecto principal, producido aparentemente por la aspiración ya del queroseno mismo o del contenido gástrico durante el vómito o el lavado, consiste en la rápida aparición de una bronconeumonía con membranas asfixiantes, que, si es suficientemente grave, puede conducir a la insuficiencia respiratoria y la muerte. Puede presentarse depresión de los centros cerebrales debida a absorción de fracciones tóxicas de queroseno o de impurezas presentes en éste, procedentes probablemente del estómago o del tubo intestinal. Si se presenta neumonía, suele ser bilateral y puede estar ampliamente diseminada; alcanza su acmé en término de dos a ocho

horas de la exposición, con regresión gradual a partir de entonces.

Debido a los efectos sumamente tóxicos hasta de pequeñas cantidades de queroseno introducidas intratraquealmente, parece manifiesto que no debe ejecutarse en modo alguno el lavado gástrico, o, que si se ejecuta, no debe llevarse a cabo sino después de introducir una sonda intratraqueal con el globo ya inflado. Hay que educar al público acerca del grave peligro que encierra para los niños pequeños la ingestión o aspiración de queroseno.

La comunicación actual se basa en una serie de 101 niños recibidos en cinco hospitales en un plazo de nueve años. En 54 de ellos hicieron exámenes roentgenológicos. Cinco casos típicos son descritos con bastante pormenor. Además, se verificaron estudios experimentales en conejos a los que se inyectó queroseno en la tráquea

DISCUSSION

J. Gershon-Cohen, M.D. (Philadelphia, Penna.): Experimental workers often end up with questions as well as answers at the conclusion of their work. The authors of this report have confirmed again the rather widely held conclusion that kerosene aspirated into the lungs is quite irritating, usually resulting in disseminated bronchopneumonitis. That lung changes were not observed after intragastric instillation of kerosene in rabbits comes as a surprise. Even though this observation has been made before, the findings are at variance with reports of some previous workers, and the reasons for these differences require explanation.

Kerosene is a complex substance and contains numerous and various impurities. One can hardly anticipate uniform biologic observations

until experimenters insist on working with standardized types of kerosene.

Since aspiration is so dangerous, the suggestion by the authors that gastric lavage be omitted in treatment seems foresighted. The natural impulse of a young doctor in the receiving ward, confronted with a case of kerosene poisoning, is to institute gastric lavage, but by this very procedure he greatly increases the possibilities of aspiration and in this way may do more harm than good.

The dangers of kerosene and the measures necessary to prevent its accidental ingestion or aspiration by children should be actively and repeatedly stressed. Labels properly setting forth the dangers and measures to prevent poisoning by these substances should be adopted and carefully supervised by the proper authorities.

Osteomatosis (Leontiasis Ossea)

Hereditary Disease of Membranous Bone Formation Associated in One Family with Polyposis of the Colon¹

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IN THE COURSE of study of a family with a high incidence of polyposis of the colon (1, 2), it became apparent that a striking coincidence existed between large bowel lesions and peculiar bony tumors of the skull and facial bones in the same members of this family. Detailed studies of the genetic aspects of the two conditions have been published elsewhere (3). The present publication represents a study of the unusual bony lesions. It is hoped that the findings will contribute some information which will help to re-evaluate the condition described in the literature as "leontiasis ossea."

REVIEW OF LITERATURE

Virchow (4) coined the term leontiasis ossea in his lectures on tumors in 1865. Several well documented cases of the condition were reported in the literature prior to that date.

Reiss (5), in 1935, reviewed 35 cases in the literature and summarized the findings: The disease is characterized by massive thickening of a single or of numerous facial or cranial bones. The process usually starts in childhood or adolescence but frequently remains unnoticed for years. The maxillae and mandible and the frontal and temporal bones are most frequently affected. Over a period of years, proliferation may involve most of the bones of the skull and may become very disfiguring. In 80 per cent of these cases, the onset was prior to the age of twenty years. An incident of trauma or infection was listed as a predisposing factor in 66 per cent. Sixty per cent of the patients were males. In 20 per cent, death was attributed to the disease, but in 60 per cent the condition

became stationary or progressed only very slowly. In two-thirds of the cases involvement was bilateral. The skeleton outside of the cranial and facial bones was involved four times, the femur three times, the hyoid bone once. An additional case of extracranial skeletal involvement of the fibula and the hyoid bone was described by Bickersteth (6).

According to Bardenheuer's review (7), the incidence of involvement of various bones in an undetermined number of cases was:

Maxillae . . .	Always	Parietal bone .	5 times
Mandible . . .	10 times	Sphenoid . . .	3 times
Frontal bone	8 times	Hyoid	2 times
Zygoma	8 times	Occipital bone	
Squama of		(anterior	
temporal		portion) . . .	2 times
bone	5 times		

Accurate accounting of all reported cases which would deserve a diagnosis of leontiasis ossea is almost impossible; inadequate illustrations and few reproductions of roentgenograms and photomicrographs accompany the descriptive reports. Identical cases appear to have been reported by more than one author. Also, many cases reported under the diagnosis of leontiasis ossea should undoubtedly, in the light of our present knowledge, be reclassified as osteitis deformans (Paget's disease), osteitis fibrosa cystica (hyperparathyroidism), or fibrous dysplasia. As late as 1933, Freedman (8) reported a case under the heading of leontiasis ossea which he himself considered to be due to Paget's disease. On the other hand, a few well documented and well illustrated cases have been referred to by most authors. The best known of these is that

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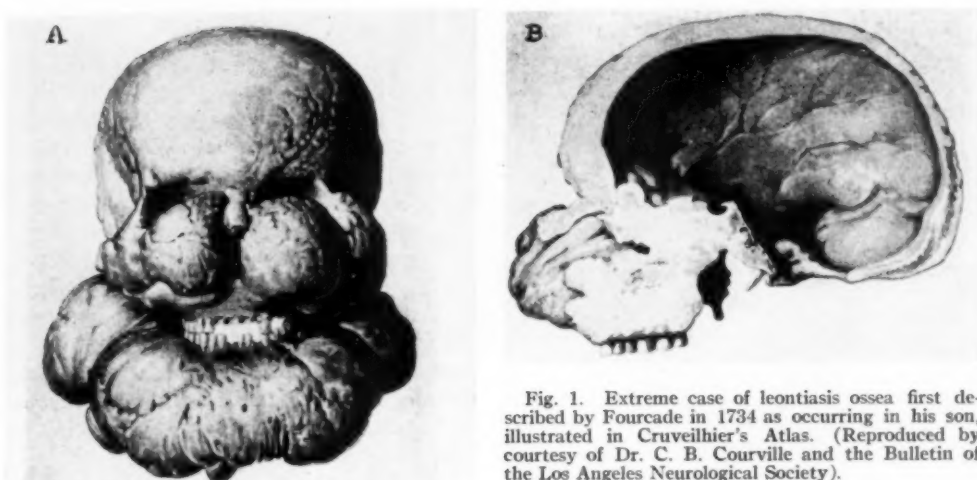


Fig. 1. Extreme case of leontiasis ossea first described by Fourcade in 1734 as occurring in his son, illustrated in Cruveilhier's Atlas. (Reproduced by courtesy of Dr. C. B. Courville and the Bulletin of the Los Angeles Neurological Society).

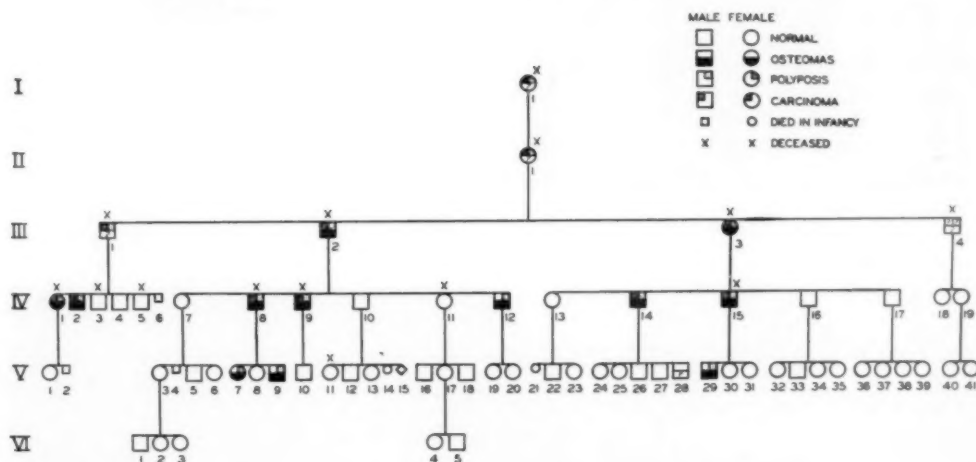


Fig. 2. Pedigree chart indicating the incidence of polyposis and carcinoma of the colon and of osteomatosis.

of Fourcade's own son, whose skull is illustrated by Cruveilhier (9) in his *Atlas* (Fig. 1).

MATERIAL AND METHODS

From a previous study centered on the incidence of polyposis of the colon, the living members of the family under consideration were well known to one of us (E.J.G.). Personal knowledge of the deceased members of the family by those living, photographs, and physicians' and hospital records added important information.

Of the 64 members of the family, 14 are dead. Forty-eight of the 50 living members, belonging to three generations, had x-ray examinations of the skull and of both forearms. If the examinations revealed any abnormality, the remaining skeleton was surveyed. Proctoscopy was done in 44. Examination of the colon, including double-contrast enema studies, was performed on all but one patient with proctoscopic evidence of polyps or a history of melena.

Pathological information on bone biopsies is available in 3 cases.



Fig. 3. Case I. Photograph of patient.

RESULTS

The age of the 48 living patients examined ranged from one to forty-seven years. Twenty-seven were females, and 21 males. In 6 patients, 5 male and 1 female, definite osteomas arising from some of the cranial or facial bones were found (Fig. 2). Additional cortical changes in the long bones were observed in 4 (IV-2, IV-12, V-7, V-9) of these 6 patients. Relatively short, thick long bones, with somewhat thickened cortices, are prevalent in this family and are particularly striking in 3 patients in whom no tumor formation of either the cranial, facial, or long bones is present.

The 6 cases with demonstrable osteomas will be reported in some detail:

CASE I: IV-2, a 45-year-old male, was first seen in December 1950, complaining of rectal bleeding two to three times a year for the past six years. He gave a history of bony lumps in his face since the age of fourteen. For most of his adult life, he had "sinus trouble." At the age of twenty-two, a solid bony tumor was removed from the sinuses.

Physical examination revealed massive bony pro-

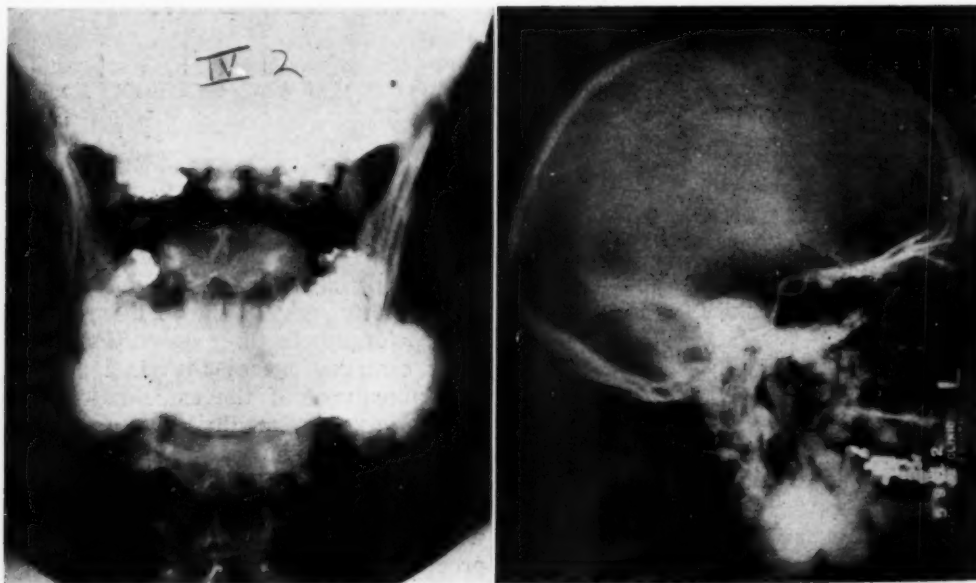


Fig. 4. Case I. Osteomas arising from the mandible, the walls of the frontal, maxillary, and sphenoid sinuses, the left zygoma, the pterygoid process of the left sphenoid, and the inner table of the frontal and temporal bones.



Fig. 5. Case I. Photomicrograph of biopsy specimen from the left side of the mandible.

tuberances arising from both mandibles (Fig. 3), as well as many soft-tissue tumors, up to 6 cm. in diameter, in the subcutaneous tissues of the forehead, back, and inguinal areas.

On sigmoidoscopy, numerous polyps were visualized. Malignant changes were present in all five biopsies.

X-ray examination of the large bowel disclosed innumerable solitary and confluent polyps throughout the entire colon.

On examination of the skull (Fig. 4), countless bony tumors measuring from a few millimeters to 7 cm. in diameter were found. Most of these arose from the walls of the frontal, ethmoid, and sphenoid sinuses and the maxillae. The trabecular structure of the maxillae was obliterated by irregular diffuse

bone formation. The largest masses were those of the mandible. The symphysis and most of the ascending rami were free from tumor growth.

Small definite bony tumors arose symmetrically from both femoral shafts. Similar bony projections protruded from the surface of both tibiae, the left fibula, and both humeri.

Colectomy was performed, and the patient died on the fifteenth postoperative day from complications. Permission for complete postmortem examination was not granted, but specimens were removed from the bony tumors of the mandible and from a soft-tissue tumor of the back. Microscopic sections (Fig. 5) revealed "a thickened cortex of dense laminated bone which breaks at irregular depths into a mosaic pattern, with interrupting small connective-tissue spaces. These latter areas emerge into an extensive central zone formed by dense, coarse, irregularly formed osseous trabeculae. The cement lines are coarse and dark-staining, and delineate a disorderly mosaic pattern of previous bone formation. The lamellae of haversian systems are conspicuous. Cartilage is not seen. There is no evidence of recent or active bone formation, or of bone destruction. The connective-tissue spaces are composed of loose fibrillary fibrous tissue encompassing a few vascular spaces, occasional foci of fat cells, and scattered round cells and polymorphonuclear leukocytes."

The diagnosis was "eburnated osteomas."

CASE II: IV-12, a 33-year-old male, was examined in July 1951, as part of the family survey. He presented no complaints. In March 1950, he



Fig. 6. Case II. Examination of the skull revealed multiple bony tumors in the frontal and temporal bones and the left side of the mandible. Lesser changes are seen in the maxillae, the zygomas, and the right side of the mandible.

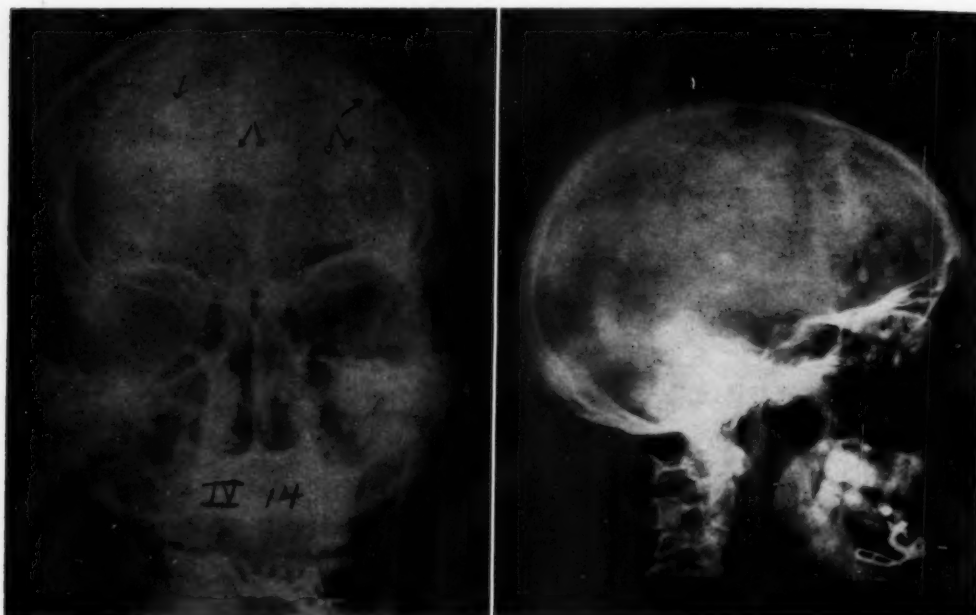


Fig. 7. Case III. Numerous bony tumors arising from the ethmoids, frontal bones, the sphenoids, both maxillae, and the left side of the mandible.

had undergone a total colectomy for polyposis of the colon. All polyps were found on pathological examination to be benign. Prior to this, numerous rectal and sigmoidal polyps had been fulgurated through the sigmoidoscope and a hydrocele had been repaired. One soft-tissue tumor removed from the back was diagnosed as a sebaceous cyst.

Physical examination revealed several soft-tissue tumors on the back and legs, measuring up to 5 cm. in diameter. These had the consistency and appearance of sebaceous cysts. A slight bony prominence of the frontal bone could be felt. No bony tumors were palpable elsewhere, and there were no other significant findings except for a colostomy opening.

X-ray examination (Fig. 6) revealed irregular islands of dense bone in the cranial vault. A small cortical tumor, 7 × 8 mm., arose from the horizontal ramus of the left side of the mandible. A flat bony projection originated in the outer table of the frontal bone 6 cm. above the root of the nose. There were slight undulation and thickening of the cortex of the right fibula, and some widening and irregularity of the medial aspect of the upper left femur. Otherwise, the long bones of the upper and lower extremities were not remarkable.

An upper gastrointestinal series revealed a mild duodenal ulcer deformity without crater.

Two soft-tissue tumors were resected. The pathological diagnosis was "epithelial retention cysts."

CASE III: IV-14, a 44-year-old male, had no complaints. He had undergone a two-stage colectomy in September 1950. Multiple benign polyps throughout the colon and an adenocarcinoma in the sigmoid colon were diagnosed pathologically. A bony tumor arising from the bridge of the nose had been removed surgically in 1927. The pathologic diagnosis was "osteoma."

X-ray examination of the skull (Fig. 7) revealed numerous bony tumors. The largest filled the ethmoid sinuses. Smaller masses, round to oval, 5 to 10 mm. in diameter, arose from the frontal bones, the roof of the orbit, the sphenoids, both maxillae, and the left mandible. The bony architecture of the mandible and of the alveolar processes of the maxillae was obliterated in part by diffuse bony growths. Only minor areas of thickened cortex were seen in the long bones of the upper and lower extremities.

CASE IV: V-7, female, age 21 years, was first seen in June 1951, for routine examination. A history of bleeding per rectum was elicited. A sebaceous cyst had been removed from the scalp.

Physical examination revealed two additional soft-tissue tumors of the scalp. Proctoscopic examination disclosed seven polyps up to 17 cm. proximal to the anus. Biopsies proved all to be benign.

X-ray examination of the large bowel revealed numerous polyps in the sigmoid and several translu-

cent shadows suggestive of polyps in the remaining colon.

Irregular thickening of the bone of the right maxilla and the greater wing of the right sphenoid, with loss of normal trabecular architecture, was seen on x-ray examination of the skull (Fig. 8). Small dense bony masses up to 1 cm. in diameter arose from the ethmoids, the frontal bone, the maxillae and the zygomas. Some projected into the antrum, others into the zygomatic fossa. The edentulous upper and lower jaws revealed irregular thickening, with obliteration of the normal architecture. A discrete bony nodule 1 cm. in diameter arose from the horizontal ramus of the mandible on the left. Moderate radial and dorsal bowing of the radius and irregular cortical thickening of both bones of both forearms was present.

Colectomy was performed in June 1951. Numerous benign polyps were found.

CASE V: V-9, a 14-year-old boy, presented no complaints when first seen in June 1951. A sebaceous cyst had been removed a year earlier. On admission he had several subcutaneous cysts of the scalp, forearms and trunk, as well as slight hypertelorism.

A solitary benign polyp 6 cm. from the anus was revealed by sigmoidoscopy on June 11, 1951, and another single, sessile polyp at 11 cm. on August 13, 1951. Radiologic examination of the colon was not performed in our department.

On examination of the skull (Fig. 9), a dense, lobulated, bony mass, $22 \times 25 \times 27$ mm., was seen filling most of the right anterior ethmoid cells,



Fig. 8. Case IV. Irregular thickening of the right maxilla and right sphenoid. Bony tumors involve the ethmoids, frontal bones, maxillae, zygomas, and the left side of the mandible.



Fig. 9. Case V. Dense lobulated mass in the right ethmoid. Minor changes of both maxillae.



Fig. 10. Case V: Moderate bowing of bones of both forearms. Undulated periosteal overgrowth of long bones.

and impinging on the right orbit and the right antrum. Several smaller tumors of lesser density arose from the right and left maxilla and projected from the posterior wall into the right antrum and into the zygomatic fossa. Less striking tumors arose from the lateral wall of the left antrum.

Moderate bowing of both bones of the forearms, with considerable wavy thickening of the cortices, was seen (Fig. 10).

Since this examination, eight months ago, progressive proptosis of the right eye has developed, with diplopia. Two abscessed teeth have been removed. Because of progressive symptoms, an operation was performed. The large bony tumor was found to lie almost loosely in the ethmoid sinus. It was shelled out without difficulty. Gross examination disclosed a solid bony mass of ivory hardness. Microscopic studies revealed thick cortical bone containing small honeycombed vascular spaces, coarse dense bone spicules, and masses of osteoid tissue. The diagnosis was: "eburnated osteoma."

CASE VI: V-29, a 20-year-old soldier, was called in for examination in June 1951. He had no symptoms. His past history recorded the removal of one sebaceous cyst from the shoulder. Physical examination revealed a soft-tissue tumor on the back of his right hand and one below the right scapula.

Sigmoidoscopy and biopsy of four adenomatous polyps was performed.

On repeated x-ray examinations of the large bowel

between July and November 1951, numerous translucent shadows suggestive of diffuse polyposis of the entire colon were seen.

Several small bony tumors arising from the posterior wall of the right maxilla and from the external pterygoid plate of the right sphenoid were found on x-ray examination. The superior orbital plates were thickened. Only minor changes involved the cortices of the long bones.

Resection of the entire colon, with ileorectal anastomosis, was performed in November 1951. Multiple benign polyps were scattered throughout the large bowel.

REVIEW OF SIX CASES

The respective ages of the 6 patients with osteomas were fourteen, twenty, twenty-one, thirty-three, forty-four, and forty-five years. All but one were males. All had polyps of the colon; 2 had adenocarcinomas. Four patients had undergone total colectomy.

Bony tumors involved the maxillae in all 6 cases. The mandible and ethmoids were affected 4 times each. Various portions of the sphenoid bone displayed changes on 4 occasions. The zygoma was involved twice, the frontal bone 3 times, and the temporal bone twice.

The most unusual and interesting feature was the associated change in the long bones. Trauner (10) found no such changes in his extensive material and could find no convincing report in the literature. Billings and Ringertz (11) reported on a tumor arising in a rib and stated that extracranial localization does not seem to have been recorded previously. Actually, however, mention has been made of involvement of the femur three times and of the fibula once (5). Bowing and irregular thickening of the cortex, occasionally exhibiting an undulated appearance, was found in 3 of our cases. True tumors arose from most of the long bones in one case. These tumors consist of solid, apparently normal bone and differ from osteochondromas in that they lack the translucent areas of cartilage and the associated amorphous calcifications.

Serum calcium and phosphate determinations were made in 3 patients. No significant changes were detected.

Six of the 14 deceased members of the family were reported to have had obvious osteomas; all 6 died from carcinoma of the colon. In 3 patients of this group, specimens of bone were examined. The pathological descriptions are compatible with the diagnosis of osteoma. Unfortunately, none of the slides are available for review.

DISCUSSION

Etiology and Pathogenesis: Since the nature of the disease is unknown, a wide variety of hypotheses have been advanced by many authors. These can be classified under five main headings: infectious, traumatic, metabolic, neoplastic, familial and hereditary.

1. The *infectious* theory of leontiasis ossea has received the strongest support even in the most recent publications. Knaggs (12) pointed out that the disease usually starts in the nasal fossae or adjacent nasal sinuses. He suggests that a low-grade infection, possibly produced by a staphylococcus, sets up an irritative

process beneath the mucous membranes. This results in the local production of bone. The infection spreads in all directions on the deep surface of the periosteum and thus may involve neighboring bones. This process is said to result in the formation of eburnated bone of marble hardness. Silberberg (13) believed that infection around carious teeth may be the inciting factor.

Courville (14), who reviewed the subject of hyperostoses of the skull most thoroughly, stated that the infectious theory seems by far the most conclusive and that there is no known characteristic of the disease to controvert it.

Little emphasis on demonstrable sources of infection can be found in the reported cases, though infectious processes, particularly in the nasal sinuses, may occur late in the disease as the result of blocked drainage by the tumor. In none of our cases was there roentgen or clinical evidence of sinusitis or of any demonstrable infection in the region of the head or neck prior to the development of the tumors. One of the patients (IV-2) complained of sinusitis for many years. However, visible bone tumors preceded the onset of sinusitis by several years.

2. While the history of a minor *traumatic* incident can be elicited very frequently in patients with this condition, as in almost any disease of bone, a direct cause-effect relationship is usually absent. The case of a pugilist reported by Howship (15) may be the most notable exception. We were unable to detect evidence that trauma may have been the cause in any of our cases.

3. The "*metabolic*" theory has enjoyed some support until the recent past. Roth and Volkman (16), Jaffe (17), and Wanke (18) suspected a disturbance of glands of internal secretions, most likely the parathyroids, to be the cause for the disturbance. Others (19) have favored the presence of hormonal imbalance and hold the pituitary and the parathyroids responsible. Reiss (5) incriminated the parathyroid glands.

Von Recklinghausen (20) considered Paget's disease to be a hypertrophic form of osteitis fibrosa and included leontiasis ossea in this group. Bockenheimer (21) believed the pathology of Paget's osteitis deformans and of leontiasis to be the same.

To our knowledge, no abnormalities of the parathyroid glands have been described in any of the case reports, nor can any reference to abnormal calcium or phosphorus levels be found.

4. Isolated osteomas arising most frequently in the frontal sinus are generally considered to be benign *neoplasms*. "Fibrous osteomas" of the jaws (20, 22-24) are closely related to the condition under discussion. The concept that we are dealing with a benign neoplasm in leontiasis ossea has not found many staunch supporters. Trauner (10) conceded that many features speak for the neoplastic nature of the condition but stated that proof was still lacking. Billings and Ringertz (11) called the condition a "growing malformation."

Many of the tumors in our material were identical in x-ray appearance, and also in the pathologic picture, with isolated osteomas arising from the accessory nasal sinuses. The fact that many lesions arise as isolated foci from various bones of the skull and face without any evidence of infection of the sinuses or teeth lends much credence to this hypothesis.

5. *Familial incidence* of this condition has been referred to on three occasions (6, 25, 26). Bickersteth (6) reported the case of a man whose thickening of the facial bones was first observed at the age of fourteen. Thirteen years later a similar tumor was found to involve the fibula. The facial tumors increased in size and infringed on the oral and nasal cavity. A brother of this patient was said to have similar hypertrophy of the maxillae. Sedgenidse (25) reported the presence of bony tumors in three members of one family. A sixteen-year-old girl presented herself with a swelling of the mandible which was diagnosed as giant-cell sarcoma following resection. Five months later,

a similar maxillary swelling developed. Resection of this tumor was followed by x-ray therapy. Roentgenograms eleven years later revealed round sclerotic areas 2.0 to 3.0 cm. in diameter and 0.1 to 1.0 cm. thick in the frontal and parietal bones, as well as a calcific mass in the left antrum. The structure of the alveolar processes was abnormal. At this time, the diagnosis of osteitis fibrosa cystica (von Recklinghausen) was made, but no serum calcium or phosphorus levels were recorded. This girl's father displayed some asymmetry of the skull, and roentgenography revealed areas of increased and decreased density, with hyperostoses of all the cranial bones, including the jaws. His father also gave a history of asymmetry of the skull, with evidence of multiple tumors of the cranial bones at postmortem examination. The author considered the presence of these lesions in three members of the family to be evidence of a dominant hereditary trait of von Recklinghausen's disease.

Frangenheim (26) reported the occurrence of similar bone lesions in two families: In the first of these, the father was said to have had bony nodules of the maxillae and mandible. In spite of four resections, these tumors always recurred. The patient died of typhoid fever. Three of his four children had bony masses in the mandible and maxillae, ranging from the size of a pea to that of a walnut. In 1 patient, the bony swelling was present at birth; in the other 2, symptoms started in childhood. The growth of these tumors appeared to increase during puberty but came to a standstill in early adult life.

The second family consisted of 3 siblings, aged twenty-eight, sixteen and nineteen years. The oldest brother had a pea-sized tumor on the left side of the bridge of the nose, enlarging over a period of years to the size of a plum. A similar tumor later developed on the right side of the nose, resulting in bilateral obstruction of the nasal passages. The two siblings displayed obstruction of the nasal passages and bilateral bony thickening of the maxillae.

Pathology: Billings and Ringertz (11) distinguish four types of tumor:

1. Least differentiated type: Osteoid fibroma. This tumor contains richly cellular connective tissue, osteoid changes with calcified centers are scattered throughout.
2. Moderately mature type: In this type the connective tissue is less cellular and vascular, and reticular spicules of bone tissue are formed.
3. The mature type is characterized by acellular and avascular connective tissue with rich collagenous substance. Bone spicules display a functional arrangement. Bone is of the mature lamellar type and contains a uniform amount of calcium throughout.
4. The eburnizing type consists partly of compact bone and partly of bone similar to that of the mature type.

Genetic Aspects: Twelve cases of multiple osteomas were found among 64 members of the family with which this paper is concerned. Of 14 deceased members, 6 were known to have had bony tumors. Two additional members in generations I and II probably also had tumors, but the information is not reliable. Three members died at eleven, twenty and twenty-nine years of age from accidents. All other deceased members died from carcinoma of the large bowel, proved or suggested, mostly prior to the fifth decade. The most advanced age reached by any member of this family was sixty-four years.

The pattern of inheritance (Fig. 2) of both polyposis and osteomas in this group is characteristic of a single dominant gene. Since all patients demonstrate both diseases, we have to assume that the same gene is responsible for both abnormalities. In every sibship where the trait is expressed, one parent is also affected. Approximately half of the children of an affected parent have the abnormalities, while all of the children of normal parents are unaffected by either disease.

SUMMARY AND CONCLUSIONS

A striking coincidence of polyposis of the colon and multiple osteomas was found in 6 living members of a family group of 64. Six deceased members displayed a similar association of the two diseases.

The facial and cranial bones were involved in the following order of frequency: maxillae, mandible, ethmoids, sphenoids, frontal bone, parietal bone, zygoma. The changes varied from localized, eburnated, well defined tumors to diffuse alteration of the architecture of an entire bone. Bowing, thickening and undulation of the cortex of long bones was observed in 3 cases. True cortical tumors of long bones arose in 1 patient.

The hereditary pattern of the two conditions, polyposis and osteomas, is suggestive of a single dominant gene responsible for both disturbances.

All tumors arose from bones which are solely or predominantly preformed in membranes. The changes in the long bones were confined to periosteal bone formation. These two observations suggest that a disturbance of membranous bone formation leading to neoplasia is the etiologic basis of the disease.

The term "osteomatosis" is suggested as preferable to leontiasis ossea, since it describes the condition more accurately and emphasizes the similarity to polyposis of the colon.

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SUMARIO

Osteomatosis (Leontiasis Osea); Afección Hereditaria de la Formación del Hueso Membranoso, Asociada en Una Familia con Poliposis del Colon

En 6 miembros vivos de un grupo familiar de 64, descubrióse una notable coincidencia de poliposis del colon con osteomas múltiples. Seis miembros fallecidos habían revelado una asociación semejante de las dos dolencias.

Los huesos faciales y craneales estaban afectados en el orden siguiente: maxilar superior, maxilar inferior, etmoides, esfenoides, frontal, parietal, malar. Las alteraciones variaron de tumores eburneos, localizados y bien definidos a modificaciones difusas de la arquitectura de un hueso entero. En 3 casos, observáronse encorvamiento, engrosamiento y ondulación de la corteza de los huesos largos. En 1 sujeto, se presentaron verdaderos tumores corticales de estos huesos.

El patrón hereditario de las dos afecciones, poliposis y osteomas, apunta a un solo geno dominante como causa de ambos trastornos.

Todos los tumores tuvieron su origen en huesos preformados exclusiva o predominantemente en las membranas. Las alteraciones en los huesos largos se limitaron a la osteogenia perióstica. Estas dos observaciones sugieren que la base etiológica de la dolencia radica en un trastorno de la formación de hueso membranoso que culmina en neoplasia.

Propónese el término de osteomatosis como preferible a leontiasis ósea, por describir el estado con mayor exactitud y recalcar la semejanza con la poliposis del colon.

Chronic Idiopathic Osteoarthropathy¹

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CLUBBING OF THE fingers and hypertrophic osteoarthropathy, as different stages of the same process, are well recognized secondary phenomena in a variety of diseases involving different organ systems. This subject has been exhaustively reviewed by Mendlowitz (6). It is not so generally appreciated that clubbing with marked bone and joint changes may occur without demonstrable underlying primary disease.

The American literature contains reports of 8 cases of idiopathic hypertrophic osteoarthropathy (1-5). The case to be reported here is believed to be the ninth to be described in this country. This patient has been followed for a period of six years, without evidence of significant progression of disability or the appearance of underlying disease. This would indicate the relative benignity and apparent idiopathic nature of the condition.

CASE REPORT

A 29-year-old Negro soldier was seen in January 1953, complaining of intermittent pain in his lower legs, with recurrent swelling of the knees. He had first experienced pain in the knees and lower legs at the age of sixteen, and symptoms had become more severe recurring with increasing frequency, especially during the winter and in damp, inclement weather. Clubbing of the fingers and toes had been present as long as the patient could remember, and he had noted no marked change in degree over the years. He denied any skin changes or changes in facial appearance. Perspiration was not excessive. As a soldier during World War II he did fairly well while in the warm, dry climate of the North African desert, but on being transferred to Italy, in October 1943, he again became symptomatic. Since that time he had experienced recurrent difficulty with his ankles and knees. He was hospitalized in 1946 because of these symptoms and observed for possible rheumatoid arthritis, but no roentgenograms of the involved joints were obtained. Except for intermittent pain and swelling of the lower extremities, he had been in general good health and had been able to carry on his normal activities as an office

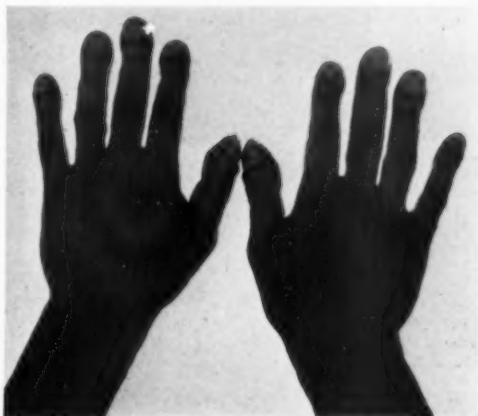


Fig. 1. Photograph of hands, showing marked clubbing of finger tips.

worker. Between exacerbations of symptoms, he was completely well.

In 1942 the patient had been hospitalized for eight weeks after a gunshot wound. There were no residua. In March 1947, he was again hospitalized, for hematuria of unknown cause. Examination, including intravenous and retrograde pyelography, was negative except for a congenital bifurcation of the left renal pelvis, which was considered to be of no clinical significance. There was no history of hereditary or familial clubbing. Roentgenograms of the mother's upper and lower extremities were negative.

Physical examination showed a well developed colored male, 67 inches tall and weighing 150 pounds. The blood pressure was 140/85 and the pulse rate 80 per minute. Pronounced clubbing of the fingers and toes was present (Fig. 1). There was bony enlargement of the ankles, and the knee joints were swollen and contained fluid. The skin, breast, prostate, external, genitalia, and hair distribution were normal, as were the findings on examination of the heart, lungs, and abdomen. The facies was not unusual.

Urinalysis was normal. The red blood count was 4,850,000; hemoglobin 14.2 gm.; hematocrit 45 volumes per cent; white blood count 8,250, with neutrophils 50, lymphocytes 41, eosinophils 8, basophils 1; the sedimentation rate was corrected to 9 mm. in an hour. Three stools were negative for ova and parasites. Cardiolipin flocculation was negative. Bromsulphalein cephalin flocculation, prothrombin time, serum bilirubin, cholesterol, alkaline

¹ From the Departments of Radiology and Internal Medicine, Tokyo General Dispensary, Tokyo, Japan. Accepted for publication in July 1953.



Fig. 2. Roentgenogram of both legs. Note increased overall density of tibial shafts resulting from irregular thickening of the cortex. Periosteal proliferation is visible in the distal tibiae.

Fig. 3. Roentgenogram of wrists. Periosteal proliferation with thickening of cortex in the distal radii is seen. Note absence of involvement of medullary canals.

phosphatase, plasma protein, and albumin-globulin ratio were all within normal limits.

Roentgenograms of the legs demonstrated diffuse thickening of the cortex of both tibiae, most marked in the mid diaphyses. Irregular periosteal proliferation was seen about the malleoli (Fig. 2). Similar changes were present in the distal radii, but to a lesser extent (Fig. 3). The medullary cavities of these bones showed no evidence of constriction, the thickening occurring only in the external cortex. The ungual tufts of the fingers were hypertrophied (Fig. 4).

Examination of the other long bones, pelvis, spine, and skull showed no evidence of involvement. The chest, studied by routine roentgenograms and bronchography, was normal, as were the findings in a gastrointestinal series, small bowel study, and barium enema examination.

DISCUSSION

Review of the collected cases of chronic idiopathic hypertrophic osteoarthropathy permits certain generalizations to be drawn. It is worthy of note, however, that not all the clinical features need necessarily appear in a given patient, the clubbing of the

fingers and roentgenographic findings in the long bones being the only constant features.

Chronic idiopathic hypertrophic osteoarthropathy is a self-limited disease, occurring predominantly in males, showing no predilection for any race or nationality, but occasionally revealing a familial tendency. Signs and symptoms become manifest in adolescence and are most commonly pain, swelling, stiffness, and enlargement of the joints of the extremities, usually the ankles, knees, and wrists. Objectively, these areas of involvement are enlarged, due in large part to lateral enlargement of the bones, but with some associated soft-tissue edema or thickening of the subcutaneous tissues. Clubbing of the fingers is present in every case. There is usually evidence of vasolability, manifested by excessive sweating. In most cases endocrine disturbance is suggested by such features as thickening and coarsen-

ing of the skin of the face and extremities, gynecomastia, striae, feminine distribution of hair, acne vulgaris, and hypertrophy or atrophy of the ungual tufts of the fingers.

The disease is a chronic one, starting with minimal symptoms in puberty, increasing in intensity into young adulthood, and finally reaching a standstill with intermittent relapses. There is apparently no interference with the normal life span, but the patients may be severely disabled during exacerbations of their symptoms.

humerus, femur, scapula, clavicle, ribs, mandible and skull. The appearance of the ungual tufts is not consistent; they may show either atrophy or hypertrophy.

The differential diagnosis consists chiefly in distinguishing this condition from secondary osteoarthropathy. Roentgenographically the findings are identical. The absence of demonstrable underlying disease, the onset in puberty, familial influence, and long course all point to the idiopathic form.



Fig. 4. Roentgenogram of hands, showing hypertrophy of the ungual tufts.

Laboratory studies have shown no characteristic or consistent findings. They contribute significantly, however, in ruling out conditions which may be confused with this disease. The diagnosis is primarily a radiologic one, and the roentgen findings are characteristic. There is proliferation of the periosteum of the long bones, commencing in the distal portions and eventually involving the entire shaft, becoming most marked in the mid diaphysis. This proliferation produces enlargement and thickening of the external cortex, with the medullary canal remaining unchanged. The distal tibiae and radii are most commonly involved, but similar changes have also been described in the

Other diseases which may be confused with idiopathic hypertrophic osteoarthropathy are acromegaly, rheumatoid arthritis, Paget's disease, syphilitic periostitis, and hereditary osteoarthropathy. Acromegaly can be excluded by the absence of enlargement of the small bones of the hands and feet, degenerative joint lesions, and changes in the sella turcica. Rheumatoid arthritis does not frequently produce periostitis and cortical thickening, and does not result in clubbing of the fingers. Paget's disease has its onset in an older age group, produces disturbance in trabeculation, and involves the medullary canal, features not seen in chronic idiopathic hypertrophic osteoarthropathy. Syphilitic

periostitis is unusual in the upper extremities, does not have the characteristic symmetrical distribution, and is usually associated with positive serologic findings. The hereditary type of osteoarthropathy may duplicate the findings of the idiopathic form. History of an hereditary tendency may be the only clue to its differential diagnosis.

The etiology of idiopathic hypertrophic osteoarthropathy is unknown. The diagnosis should be made with caution, and only after every possible primary etiologic factor has been excluded. This is particularly true since the incidence of the secondary form is relatively high in pulmonary cancer. The subjective symptoms of such a neoplasm may be entirely those of the osteoarthropathy, with the primary lesion remaining silent.

SUMMARY

A case of chronic idiopathic hypertrophic osteoarthropathy, believed to represent

the ninth such case in the American literature, has been presented. The salient features manifested by the collected cases have been summarized, and the importance of differentiating this condition from the secondary form is pointed out.

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SUMARIO

Artropatía Hipertrófica Idiopática Crónica

En la literatura médica de los Estados Unidos aparecen 8 casos de osteoartropatía hipertrófica idiopática crónica. Preséntase ahora el noveno caso, y trázanse ciertas generalizaciones.

La afección predomina en los varones, revelando a veces tendencia familiar. Los signos y síntomas—dolor, edema, rigidez e hipertrofia de las articulaciones de los miembros—se manifiestan en la adolescencia, se intensifican en la juventud y por fin se estacionan, con recidivas intermitentes. Hay siempre dedos hipocráticos.

Los hallazgos roentgenológicos son típicos. Existe proliferación del periostio de los huesos largos, comenzando en las porciones distales y comprendiendo con el

tiempo toda la corteza, sin que se afecte el conducto medular. Las porciones distales de las tibias y los radios son las atacadas más frecuentemente. Los plexos ungulares pueden revelar bien atrofia o hipertrofia.

La principal dolencia que hay que diferenciar es la osteoartropatía secundaria. Los hallazgos roentgenológicos son idénticos. Características distintivas son la falta de afección subyacente observable, la iniciación en la pubertad, un posible factor familiar y la evolución prolongada.

Al parecer, no se afecta la duración normal de la vida, pero los enfermos pueden quedar incapacitados seriamente durante las exacerbaciones de los síntomas.

Biological Effectiveness of High-Speed Electron Beam in Man¹

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THE ELECTRON beam from the medical betatron at this institution was successfully extracted in March 1950. It was reproducible in quality and quantity without difficulty for a variety of physical and animal experiments, and was first applied to man in March 1951, at energy levels up to slightly above 19 mev. The Siemens 6-mev betatron had been used previously by the Göttingen group (1, 5, 6, 8, 9) for extensive biological investigations and for therapy of superficial lesions, most of which were treated below the 6-mev rating of the machine. Since there is no essential physical difference between 6-mev and 20-mev electrons aside from depth of penetration, no marked difference in biological effectiveness or biological results was expected in our experience. The data from the lower-energy ranges could not, however, be transferred directly to our higher-energy ranges without a practical evaluation, because of the possible influence of different depth distributions and volume doses. Kepp (5) found the electron beam more effective on human skin than 200-kv. x-rays and attributed this to the fast subsurface dose increase with 2- to 5-mev electrons. He also found that increase in electron energy enhanced the effect. Bode, Paul, and Theismann (1) verified Kepp's findings, but Schubert (9) emphasized that there was no difference in biological effectiveness between 2 and 5 mev.

Preliminary animal experiments had indicated that the LD 50/30-day dose for 28-day-old male albino rats was 770 r, with 19-mev electrons with upper and lower confidence limits of 835 r and 710 r for 19/20 probability; 750 r with 23-mev betatron x-ray beam, with upper and lower confidence limits of 810 r and 695 r; and 600 r

with the 400-kv. x-ray beam, with upper and lower confidence limits of 645 r and 558 r (2). Studies on lymphoid tissue effects in rats had also indicated that the high-energy electron beam was significantly less active quantitatively than conventional x-ray beams (2). The graying of hair in mice exposed to 200-kv. peak x-rays, 22-mev peak x-rays, and 18 mev electrons has been compared by Quastler *et al.* (4, 7), who determined that for this reaction the effectiveness of the high-energy x-rays and high-energy electrons was the same, being approximately 0.7 that of the 200-kv. x-rays. The values of *r* used here refer to determinations by a Victoreen thimble chamber surrounded with a sufficient additional thickness of air equivalent absorber to obtain electronic equilibrium. For the three qualities of radiation employed, a similar *r* measurement means a similar energy dose within an uncertainty of about ± 10 per cent. Differences between ratios of biological effectiveness up to ± 10 per cent may not be significant, but beyond ± 10 per cent they cannot be ascribed entirely to physical dosimetry. Regardless of whether or not the difference in the ratios is significant, one has to make use of it as a possible guide in practical application in clinical therapy until more data are available regarding the ratio.

The studies on man took three forms: (a) multiple dose exposures of similar areas of normal skin in patients approaching an advanced state of cancer; (b) comparative irradiation of multiple visible or palpable metastases with different types of radiation; (c) clinical observations on the effects on skin, mucous membrane, and tumors in 13 patients considered suitable for this type of cancer therapy.

¹ From the Department of Radiology, University of Illinois College of Medicine, Chicago, Ill. Accepted for publication in July 1953.

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Fig. 1. Skin test on lateral aspect of the thigh with different doses of 17.3-mev electrons (upper row) and 200-kv. x-rays (lower row).

EXPERIMENTAL SKIN TESTS

A row of circles 2 cm. in diameter on the lateral aspect of the thigh were exposed to different dose levels of 17.3-mev electrons at a rate of 200 r/min. and a parallel row of similar areas to 200-kv. x-rays (0.75 mm. Cu h.v.l.) at 45 r/min. The lateral surfaces were chosen for convenience of application with our industrial model fixed beam betatron (Figs. 1 and 2). For technical reasons, the dose rate differed between the two qualities of radiation, but this difference was not considered of great significance in determining the effect. Twenty-two areas were exposed to each of the different qualities of radiation on four patients. The number of comparative irradiations is too small for statistical analysis, but the following observations were made on single exposures:

No definite reaction..	600-900 r of electrons
Threshold erythema..	800-1,000 r of electrons (in greatest frequency: 1,000 r)
	520-690 r of 200-kv. x-rays (in greatest frequency: below 600 r)
Standard erythema...	1,000-1,300 r of electrons*
	600-800 r of 200-kv. x-rays
Hypererythema.....	1,200-1,600 r of electrons*
	700-1,000 r of 200-kv. x-rays

* The frequency of reaction is greatest close to the upper figures.

Oozing epidermitis was not observed in the range explored. These figures indicate a latitude of dosage for similar reactions, but this is an admitted limitation of this kind of biological indicator.

Comparison of doses which produced seemingly similar degrees of skin erythema yielded ratios of biological effectiveness

(17-mev electrons vs. 200-kv. x-rays) between 0.63 and 0.69. There were two isolated extreme ratios of 0.59 and 0.60 respectively in the threshold erythema group, and one ratio of 0.83 for a hypererythema reaction. In the latter there was a good



Fig. 2. Skin test on lateral aspect of the thigh with different doses of 17.3-mev electrons (upper row) and 200-kv. x-rays (lower row).

possibility of patient motion during exposures. No claim is made for the significance of the second digit. All observations were made by a single clinical observer (L. L. H.)

COMPARATIVE SKIN EFFECTS OF THERAPEUTIC RADIATIONS

Single therapeutic doses of 6.2-mev electrons were applied to multiple chest wall metastases in a patient with melanoma (Fig. 3). Doses of 1,200 and 1,400 r to 2-cm. ϕ fields produced no definite skin reaction nor any tumor regression; 1,600 r produced a marked erythema, which subsided in six days with temporary regression of the tumor mass; 2,000 r caused an intensive hypererythema and persistent tumor regression; 2,500 r caused a mild oozing epidermitis which lasted 16 days. A dose of 1,200 r to a 6-cm. ϕ axillary field produced a threshold hyperemia with temporary decrease in tumor nodes.

Comparative fractionated irradiations were also performed on the same patient. A mass in the anterior axillary line received 9,500 r of 17.3-mev electrons in five and a half weeks. A similar mass over the clavicle received 6,000 r/skin of 200-kv. x-rays

in four and a half weeks. A little later a third mass in the inguinal area received 7,400 r/skin of 200-kv. x-rays in four and a half weeks. The resulting epidermolysis (Fig. 4) was intense in all three fields. The degree increased in the following se-



Fig. 3. Metastatic nodes of malignant melanoma, irradiated with different single doses of electron beam and 200-kv. x-rays, showing, accordingly, different degrees of skin reaction and of tumor regression.

Fig. 4. Same patient following dose of 9,500 r of 17.3-mev electrons in five and a half weeks to tumor mass in the right axilla. Epidermolysis.

quence: right supraclavicular field, right chest field, left inguinal field.

The duration of oozing was in the same order; the 6,000 r/skin x-ray area healed



Fig. 5. Breast carcinoma, treated with 10,000 r electrons in thirty-five days. Radiation necrosis in the center.

in forty-nine days and the 9,500 r electron area in eighty-three days, while the skin effect produced by the x-ray dose of 7,400 r was deeper than the others from the start. It could be followed for only sixty days, when it corresponded to the forty-day stage for the electron-treated field. The latter showed a rapid rate of regression at that time, while the x-ray-treated area was more sluggish. The impression from these observations was that an electron dose of 9,500 r was equivalent to a dose about midway between 6,000 and 7,400 r of 200-kv. x-rays. It corresponds to an effectiveness of approximately 0.70 on the skin, which is slightly higher than the η 0.60 for 23-mev x-rays previously reported (3).

EMPIRICAL CLINICAL OBSERVATIONS

Empirical observations on 13 patients treated with the electron beam furnish additional useful data concerning skin reactions.

A. A patient with a breast neoplasm received 10,000 r in thirty-five days. The epidermolysis underwent a favorable initial regression only to be converted to an increasing radiation necrosis (Fig. 5.)



Fig. 6. Patient shown in Figs. 3 and 4, with melanoma; 6,000 r/skin of 200-kv. x-rays to the right supraclavicular mass. The post-irradiation skin atrophy is less marked than in the right axillary field, irradiated with 9,500 r electrons (Figure 4).



Fig. 7. Parotid tumor. Marked skin atrophy, chronic radiodermatitis, after 9,500 r electrons.

B. The epidermolysis in one axillary line area given 9,500 r for melanoma healed in eighty-three days, but the skin atrophied, and telangiectasia was concomitant. Another lesion on this same patient received 6,000 r at 200 kv., and the skin healed in forty-three days. The following atrophy was less marked than on the field previously treated with electrons (Fig. 6).

C. A dose of 9,500 r in forty days to a parotid adenoacanthoma resulted in rather severe atrophic appearances of the skin (Fig. 7).

D. Four patients who received 9,000 to 9,200 r for surface or subsurface lesions also showed a little more intensive reactions than desired.

E. Three patients receiving 8,600 r in thirty-three days (neck, antral, and temporal area) showed healing in forty-two, sixty-two, and seventy days, respectively. The intensity of each reaction and course of healing corresponded to conditions usually associated with 6,000 r/skin at 200 kv., also fractionated (Figs. 8-10).

The post-irradiation mucositis is not suitable for quantitative comparison, since the field and dose distribution of the electron beam are so different from x-rays. Generally the degree of mucositis observed in electron cases was more limited and healing was more rapid and favorable than after x-ray treatments, because the volume of irradiated peritumoral tissue is much smaller, the tumor bed is less damaged, and therefore recovery from the reaction is faster. The rate and degree of tumor regression in these 13 patients suggest that, with an electron beam of 17.3 mev, 8,600 r produces a result about equal to what one is accustomed to see with a 6,000 r tumor dose at 200 kv.

COMMENT

The ratio of biological effectiveness, in man, of the different types of radiation, as obtained in these studies, may be accepted as an approximate value with a fair degree of certainty, since the different ways of observation resulted in similar conclusions, and the practical therapeutic application confirmed its reliability.

Accumulation of additional data is hampered by the present need for separate tubes for x-ray and electron beam work with the betatron and the accompanying



Fig. 8. Antral carcinoma; 8,600 r of 17.3-mev electrons in thirty-three days to one field. Skin reaction healed with moderate pigmentation and atrophy after slight oozing and moderate scaling.



Fig. 9. Metastatic lesion of the right temporal area; 8,600 r electrons in thirty-three days. Epidermolysis healed with depigmentation and moderate atrophy.



Fig. 10. Extensive bilateral antral carcinoma, irradiated through two fields, 8,600 r of electrons in thirty-three days. Moderate oozing and thick crusting, healing with moderate pigmentation and atrophy.

long change-over time. First, priority was given to collecting experiences and elaborating principles of use of the x-ray beam, since the larger, deeper, and more life-threatening types of cancer more often require its deeply penetrating beam than the limited penetration of the electron beam at available energies.

The ratios for human skin and tumors differ somewhat from the LD figures for rats. Both high-energy electron and x-ray beams showed similar effectiveness on the LD of rats, while the electron beam was more effective on human tissues. It is well known (5) that effectiveness differs in various species and tissues. The effect of total-body irradiation is a complex interaction of reactions in several organs, which thus far cannot be quantitatively analyzed in separate fashion. Comparative evaluation of skin reactions is more subjective but more direct, since the skin reaction is a relatively less complex biological process.

SUMMARY

1. Comparative skin tests on human thigh areas showed the biological effectiveness of the 17.3-mev electron beam as compared to 200-kv. x-rays to be between 0.63 and 0.69. [η (17.3-mev electrons @ 200 kv. x-ray / unit r \cong 0.63 - 0.69.)]

2. A threshold erythema was produced by 800 to 1,000 r electrons, a standard erythema by 1,000 to 1,300 r electrons (most often nearer the upper figures).

3. Therapeutic irradiations with different single doses and at different voltages showed that a significantly larger physical r dose of electrons was necessary to produce similar degrees of skin reaction and tumor regression than was required with 200-kv. x-rays.

4. Therapeutic irradiations with frac-

tionated doses of electrons on multiple areas of the same patient resulted in a ratio (η) of 0.70 for biological effectiveness of the electrons versus 200 kv. in the skin.

5. Clinical observations on 13 patients showed that 10,000 and 9,500 r administered in four and a half to five and a half weeks produced more intensive skin reactions than usually follow 6,000 r of 200-kv. x-rays. The electron equivalent dose for 6,000 r of 200-kv. x-rays is about 8,600 r ($\eta \cong 0.70$.)

6. The electron ratios are slightly higher for man than the ratio of 0.60 previously found for 23-mev betatron x-rays.

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SUMARIO

Eficacia Biológica del Haz de Electrones de Alta Velocidad en el Hombre

Los estudios presentados versan sobre la eficacia del haz de electrones de alta velocidad procedente del betatrón en su aplicación al hombre.

Cutirreacciones comparativas en zonas del muslo humano revelaron que la eficacia biológica del haz de electrones de 17.3 mev, comparada con rayos X de 200 kv., que-

daba entre 0.63 y 0.69. Un eritema umbral fué producido por una dosis de 800 a 1,000 r de electrones; un eritema estándar por 1,000 a 1,300 electrones (lo más a menudo con las cifras más altas).

Las irradiaciones terapéuticas con distintas dosis únicas y a distintos voltajes revelaron que se necesitaba una dosis física significativamente mayor en r de electrones para producir grados semejantes de reacción cutánea y regresión de tumores que la requerida con rayos X de 200 kv.

Las irradiaciones terapéuticas con dosis fraccionadas de electrones aplicadas a zonas múltiples del mismo enfermo dieron

por resultado un proporción de 0.70 de eficacia biológica para los electrones, comparado con 200 kv. en la piel.

Las observaciones clínicas realizadas en 13 enfermos revelaron que 10,000 y 9,500 r administrados en cuatro y media a cinco y media semanas producían reacciones cutáneas más intensas que las provocadas habitualmente con 6,000 r de rayos X de 200 kv. La dosis de electrones equivalente a 6,000 r de rayos X de 200 kv. es de unos 8,600 r.

Las proporciones de electrones son ligeramente mayores para el hombre que la proporción de 0.60 previamente obtenida para los rayos X de 23 mev del betatrón.



Renal Echinococcus Disease¹

I. R. BERGER, M.D., and G. T. COWART, M.D.

RENAL HYDATID disease is an uncommon occurrence in this country, although in pastoral countries it is not infrequent. Baurys (3) stated that only 35 cases had been reported in the United States at the time he added one case in 1952. The incidence of renal involvement has been variously estimated as from 2 to 9.6 per cent of all cases of echinococcosis. In reviewing renal cystic disease on the urology service of the New York Hospital, Lowsley and Curtis (6) found 2 instances of echinococcosis among 74 cases. Baurys found only 1 case of renal involvement in 240,000 hospital admissions.

ETIOLOGY

Hydatid disease or echinococcosis is a condition in which a cyst or hydatid develops following infestation by the intestinal tapeworm of the dog, *Taenia echinococcus*. Man is infested chiefly as a result of close contact with dogs. Other intermediate hosts are sheep, swine, and cattle.

The parasite in the adult stage measures from 2 to 8 mm. in length and consists of only four segments, the rounded head, presenting a double row of hooklets, and three bisexual segments (2, 7). The eggs are conveyed to man through water and raw vegetables contaminated by cattle or dog feces. When the ovum is ingested by man, its capsule is dissolved in the stomach and there the ovum changes into the intermediate larval form or scolex, encased in the cyst. The larvae then pierce the small bowel wall and pass into the portal or vena caval circulation or into the thoracic duct. The liver is affected in 75 per cent of cases. To reach the systemic circulation, the parasites must pass through the capillary circulation of the liver and, in turn, the capillary bed of the lungs. When they finally reach the kidney, they become

vesiculated and development proceeds to the adult cystic stage (9).

PATHOLOGY

The adult cyst wall is layered. The adventitia or outer layer arises from a cellular reaction in the surrounding renal tissues and resembles the fibroblastic reaction about a tuberculous focus (9). This layer is an intimate part of the host kidney and may contain blood vessels. Within the outer layer is the characteristic laminated membrane common to echinococcus cysts of the liver, kidney, and lung (1, 9). This protects the growing scolices on its inner surface and, by its selective osmotic properties, provides nourishment for the germinal elements. These develop first as follicular growths and subsequently as brood capsules containing scolices.

The entire cyst secretes fluid into its lumen and slowly enlarges. A diameter of 10 cm. may be reached in ten months (10). It is the consensus that the usual renal hydatid is of many years duration.

After the cyst has reached its definitive form, several courses may be followed (9): (a) The cyst may become latent. The adventitia may thicken and become fibrosed, curtailing cyst nutrition. Calcium may then appear in the cyst wall (closed cyst). (b) Daughter cysts may develop within the cyst lumen. (c) The cyst may rupture (open cyst). (d) Suppuration may occur.

By definition, a *closed cyst* is one in which the laminated and adventitial walls are intact. A *pseudo-closed cyst* is one in which the adventitia has presented into a calyx and becomes absorbed. The laminated membrane retracts and a potential space is found between it and the calyx. An *open cyst* is one in which both laminated and adventitial layers have ruptured. The cyst and calyceal lumina are in direct continuity.

¹ From the Radiology and Urology Services, VA Hospital, Atlanta, Ga. Accepted for publication in June 1953

The open type of cyst may be followed by infection and by implantation of daughter cysts elsewhere in the kidney.

SYMPTOMATOLOGY

Symptoms vary with the type of cyst. A large closed cyst may be asymptomatic. Pain simulating renal colic may follow impingement upon a calyx by a pseudo-closed cyst, while severe colicky pain may be associated with open cysts, due to passage of daughter cysts down the ureter. Weight loss and hematuria accompany many open cysts. Rupture of the cyst into the peritoneum may cause a severe anaphylactoid reaction, and even death. Kretschmer (5) and others (8, 9) stress the passage of the hydatid membranes in urine as pathognomonic of the disease.

DIAGNOSIS

In the United States, because of the infrequency of the disease, a correct diagnosis is rarely made preoperatively. Of the 17 cases reviewed by Kretschmer, only 4 were diagnosed preoperatively, and 3 of these showed daughter cysts in the urine. Eosinophilia is almost always present along with a mass, usually non-tender, in the renal region. Complement-fixation and intradermal tests are available to aid in diagnosing the disease.

Reay and Rolleston (9) have presented the clearest picture of the roentgen findings. The plain film of the abdomen may disclose a mass with or without calcification. Pyelograms aid in determining the degree of renal function and presence or absence of obstruction, and in most instances afford a clearer definition of the kidney. A small cyst of the "closed" type may produce no deformities of the calyces, while a large cyst causes calyceal and pelvic distortion. When the cyst is of the "pseudo-closed" type, the opaque medium may collect between the laminated membrane and the calyceal wall and produce the so-called "wine-glass" appearance. In the event the cyst is of the open

cyst cavity and the calyx is found. In the case to be reported here, presacral perirenal pneumography was used in an effort to outline completely the affected kidney.

In the presence of an open cyst, cystoscopy may reveal evidence of vesical inflammation and a widely patent, ragged ureteral orifice. Pressure on an open cyst may produce discharge of its contents from the ureter.

PROGNOSIS

The disease may terminate fatally if untreated. Twenty to 25 per cent of cases show calcification of the cyst wall with resultant destruction of the contents.

TREATMENT

Nephrectomy is usually essential. Sixty per cent of patients show cysts elsewhere, according to Dew (4). Marsupialization and injection of the cyst with formalin have been practiced by some with success.

CASE PRESENTATION

C. S., a 33-year-old colored male, was admitted on Jan. 23, 1952, complaining of a mass in the right upper quadrant and intermittent sharp pains in the right paraumbilical region for two days. On the day before admission, he experienced a cramping pain in the right lower quadrant lasting several minutes, followed by a fever of 101.5° F. The only urological complaints were diurnal and nocturnal frequency of urination. The patient had been anorexic and had lost 20 pounds of weight during the last six months. According to his past history, an echinococcal cyst had been removed from the right lung by lobectomy, while he was in the Army in 1943. He had been in England, Italy, and North Africa from 1941 to 1943.

Positive physical findings were a blood pressure of 190/130, an enlarged heart, and a right thoracotomy scar, as well as a large, smooth, very tender mass in the right upper quadrant. This mass descended on respiration; it appeared to be attached to the liver and presented directly beneath the abdominal muscles.

Significant laboratory findings were a hemoglobin of 10 gm. and a red blood count of 3,560,000. Westergren sedimentation rate was 35 mm. in one hour. Urinalysis was normal except for a trace of albumin and 12 to 15 white blood cells. No evidence of echinococcus was found in three urine specimens. The leukocyte count was 7,900, with 5 per cent eosinophils.

One of the authors (G.T.C.) saw the patient, as



Fig. 1. Retrograde pyelogram showing marked downward displacement of calyces by huge cystic mass in upper pole of right kidney.

a urological consultant. It was thought that the mass was palpable separate from the liver edge, extending posteriorly in the flank, apparently involving the kidney. Intravenous urograms showed a very large (12×12 cm.) mass apparently attached to the upper pole of the right kidney, with marked downward displacement and pressure defects of the upper and middle calyces. There was no evidence of calcification.

Retrograde pyelography confirmed the presence of a mass within the upper pole of the right kidney, with the kidney pushed downward and forward (Fig. 1). A nephrogram was of poor diagnostic quality, but showed absence of contrast medium within the tumor. Presacral perirenal pneumography clearly outlined the left kidney. The right renal area was not demonstrated as well, but in one film the tumor appeared to be confined intrarenally. The air dissected along the right psoas bundle and along the inferior and lateral margins of the right kidney but failed to dissect along the superior pole. This was interpreted as indicating adhesions between the renal capsule and retroperitoneal tissues (Fig. 2). It was our impression that we were dealing with an echinococcus cyst of the upper pole of the kidney, although the urine failed to offer confirmatory evidence.

On Feb. 1, 1952, through the right 12th rib bed, the right renal region was explored. A huge, opaque, pinkish-white cyst of the upper pole of the kidney, attached firmly, both superiorly and medially, to the diaphragm and peritoneum, was encountered. Nephrectomy was deemed essential because the diagnosis was still echinococcus cyst and because there was a minimum of normal kidney remaining. Pathological study later confirmed the diagnosis (Fig. 3). Because of the dense adhesions



Fig. 2. Presacral retroperitoneal pneumogram showing sharply outlined left kidney and air outlining lower pole of right kidney. Failure of delineation of the remainder of the right kidney was interpreted as indicating extension of the cystic process into the perirenal tissues.

of the cyst to the diaphragm, peritoneum, and liver, dissection was extremely difficult. Inadvertently, three surgical complications occurred: the cyst was ruptured, the inferior vena cava torn, and the peritoneum opened. Thick, milky mucoid material exuded from the cyst. Suture of the vena cava was difficult because the tear was directly opposite the left renal vein. When the peritoneum was opened, one hepatic and two omental cysts were seen. These were removed.

The patient was in prolonged shock during and following surgery, probably due both to loss of blood, which was replaced by ten transfusions, and to anaphylactic shock due to rupture of the cyst. The temperature rose to 105.4° after operation. Heparin therapy was instituted in an attempt to

prevent pulmonary emboli secondary to anticipated vena caval thrombosis. Postoperatively, a severe oliguria developed, thought to be due to a lower nephron nephrosis, although the possibility of left renal vein thrombosis was considered. The usual diuretic measures were effective, and the patient showed some improvement. A small pulmonary infarct developed on the fifth day. Death occurred on the eleventh day as a result of a massive pulmonary embolism.



Fig. 3. Operative specimen: Right renal cyst. Cyst has been opened. Small daughter cyst may be seen on its inner surface. Residuum of normal right kidney at lower margin of specimen.

The fatal pulmonary embolus was expected because of the laceration of the vena cava, the previous small infarct, and the necessity for discontinuing heparin therapy on the seventh day because of profuse bleeding from the operative incision (Fig. 4).

At autopsy three more cysts were found, one retrovesical and two omental. At least one of the cysts (the one ruptured at operation) contained numerous scolices.

Microscopically, the wall of the renal cyst was composed of dense collagenous connective tissue. Adjacent to this was a broad zone of fibrosis. The luminal surface of the wall was irregular in thickness and necrotic in numerous areas. At one point within the cyst lumen was a rounded body with a heavy eosinophilic capsule and an internal structure

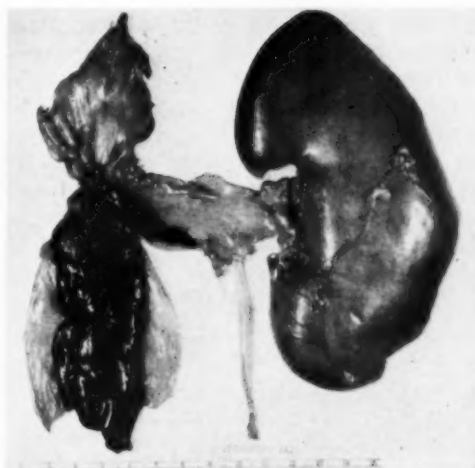


Fig. 4. Autopsy specimen: Inferior vena cava containing large antemortem clot, originating at the suture line. Normal left kidney.

composed of myxomatous appearing tissue. In the center of this was a condensed mass of cells, among which were numerous chitinous hooklets (secondary or daughter cyst) (Fig. 5). There was striking eosinophilic infiltration near the remnants of the cyst wall left under the liver. Vessels in this area, and to a lesser extent in the lung, showed fibrinoid degeneration and surrounding infiltrates of segmenters. Foreign-body reaction was also seen. Also of interest were cystic medial necrosis of the aorta, thrombosis of the prostatic plexus of veins, thrombosis of the inferior vena cava and of two-thirds of the left renal vein, and hypertensive cardiovascular disease.

The renal cyst was apparently of the "closed" type although the history suggested either passage of the cyst contents down the ureter or slow rupture into the peritoneum.

SUMMARY

Echinococcus disease is unusual in this country. Involvement of the kidney occurs in 2 to 9.6 per cent of all cases, appearing only after the parasites have spread through the systemic circulation from the lungs. A brief description of the disease and of the life cycle of the parasite is given.

A complicated case, apparently the thirty-seventh of renal involvement in the United States, is reported. This appears to be only the second case suspected preoperatively without evidence of the dis-

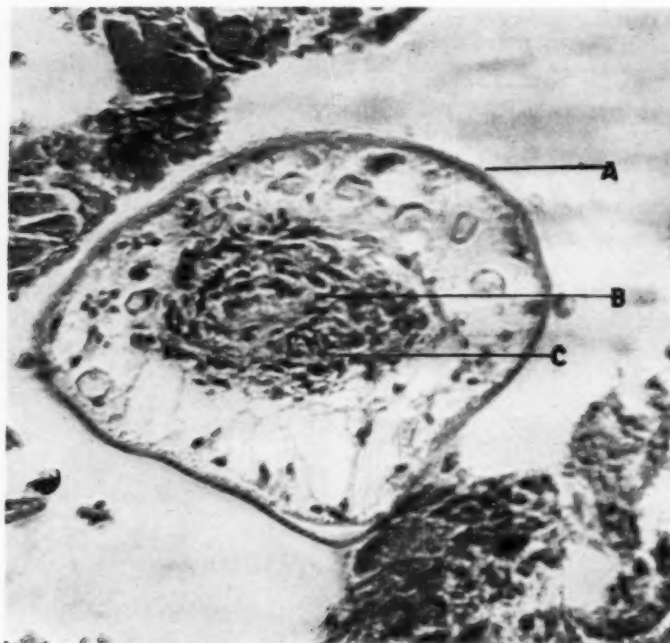


Fig. 5. Photomicrograph of a small daughter cyst showing transected cyst wall (A) and scolex (B). The hooklets (C) can be seen as parallel dark bands within the scolex.

ease in the urine. Previous lobectomy for echinococcus disease furnished the clue to the diagnosis.

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SUMARIO

Hidatidosis Renal

La equinocosis es una enfermedad que ocurre raramente en los Estados Unidos. La incidencia de la invasión renal representa, según los cálculos de varios autores, de 2 a 9.6 por ciento del total de casos. El riñón

se afecta únicamente después que los parásitos se difunden por la circulación general desde los pulmones.

Preséntase un caso de equinocosis renal, que parece ser el 37o. en los Estados

Unidos, y el segundo sospechado preoperatoriamente a falta de deutoescólices en la orina. Las radiografías revelaron una gran tumefacción en el polo superior del riñón izquierdo, con desplazamiento de éste hacia abajo y defectos debidos a la

compresión de los cálices superior y medio. El hecho de que el enfermo había sido objeto antes de una lobectomía por hidatidosis aportó una clave en cuanto a la naturaleza de la tumefacción. La muerte se debió a complicaciones postoperatorias.



The Roentgen Demonstration of Cirrhosis of the Liver with Fatty Metamorphosis

Report of a Case Due to Congenital Fibrocystic Disease

HOWARD L. STEINBACH, M.D., JACKSON T. CRANE, M.D., and HENRY B. BRUYN, M.D.¹

THE DIAGNOSIS OF cirrhosis of the liver ordinarily cannot be made on the basis of the routine roentgen examination. In those cases in which there is a large spleen associated with varices of the esophagus, the diagnosis of cirrhosis may be suspected on the basis of the roentgen examination, particularly if the liver is also enlarged. However, there are other diseases, such as Banti's syndrome and portal vein thrombosis, which may present the same roentgen findings.

We are reporting a case of congenital fibrocystic disease with associated cirrhosis in which the diagnosis of cirrhosis was established entirely on the basis of the plain roentgenogram of the abdomen.

CASE HISTORY

The patient was a male child first seen in the University of California Fibrocystic Clinic, Dec. 22, 1949, at the age of twenty-six months. He was referred to the clinic because of a diagnosis of fibrocystic disease.

Two siblings had died of conditions which resembled fibrocystic disease.

The patient had been followed by the referring physician since early infancy. The diagnosis of fibrocystic disease had first been made at the age of three weeks, when the child was readmitted to the hospital because of excessive weight loss and foul, greasy stools. During his first year of life, he was placed on a banana and protein diet, together with an enteric coated pancreatin preparation. During early infancy he had a few episodes of upper respiratory infection, which responded to sulfonamide and penicillin. At about fourteen months of age, the respiratory symptoms became more severe and were not controlled completely by penicillin and streptomycin.

Roentgenograms of the chest on Dec. 22, 1949, revealed a rather marked pulmonary emphysema. The bronchovascular markings were increased in prominence, and there were mottled densities along their course which were thought to be due to an inflammatory process. The examination was

repeated on Feb. 13, 1952, at which time there had been no significant change.

The child was started on aureomycin therapy, receiving doses of 125 mg. twice daily. Following this, he showed a gain in weight, and the respiratory symptoms were relieved to some extent. In October of 1950 the mother reported swelling of his legs and feet. He was given a protein hydrolysate preparation, together with increased vitamins, including folic acid and liver and stomach fractions. Following the institution of this regime, he seemed to improve rather markedly.

About two months later the patient was found to have an enlarged liver and spleen. The liver extended about 5 or 6 cm. below the right costal margin, and the spleen was palpable 2 cm. below the left costal border. The total protein was 7.1 gm. per 100 c.c.; albumin 3.2 gm.; globulin 3.9 gm.

Three months later the swelling of the feet and ankles reappeared, progressing upward to the abdomen. Examination revealed a tense, distended abdomen, with pitting edema of the ankles and calves.

The stools at this time were consistently negative for tryptic activity, by the x-ray film test. Vitamin A absorption test showed a very low uptake of the vitamin, compatible with the general fibrocystic disease. The non-protein nitrogen was 30 mg. per cent, total proteins 7.3 gm. per 100 c.c.; albumin 2.7 gm.; globulin 4.6 gm. The urine contained urobilinogen in a dilution of 1 to 10, but not at 1 to 20; the cephalin cholesterol flocculation test was 2 plus at forty-eight hours, 1 plus at twenty-four hours. The thymol turbidity was 5 units.

An intravenous urogram on April 12, 1951, revealed no evidence of disease in the urinary tract. It was noted on this examination, however, that the liver shadow was considerably larger than normal. Scattered throughout the liver were poorly defined areas of radiolucency. This was interpreted as indicative of cirrhosis with associated fatty metamorphosis (Fig. 1).

Exploratory laparotomy was performed in order to rule out the possibility of a neoplastic process. At operation the liver was found to be involved throughout by firm, light-colored nodules varying from 4 mm. to 3 cm. in diameter. The pancreas was more firm than usual, and there were approximately 4 to 5 c.c. of clear, light yellow fluid in the peritoneal cavity.

¹ From the University of California School of Medicine, San Francisco, Calif., Departments of Radiology (H.L.S.), Pathology (J.T.C.), and Pediatrics and Medicine (H.B.B.). Accepted for publication in July 1953.

The pathological report was as follows:

"*Gross Description:* A small wedge-shaped biopsy of liver tissue exhibits mild capsular thickening and marked nodularity of the pale yellow parenchyma.

"*Microscopic Description:* There is considerable distortion of the hepatic architecture, manifested by a rather unusual type of cirrhosis and marked fatty alteration of the hepatic parenchyma. Separating the parenchymal tissue into various sized

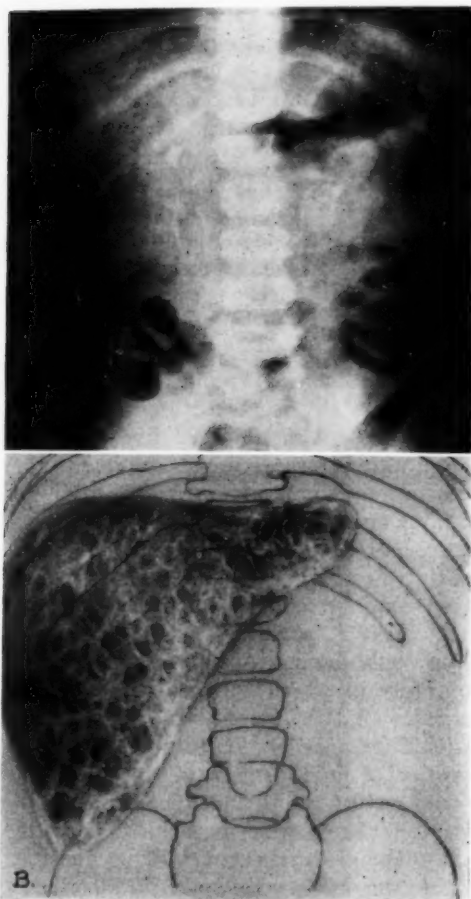


Fig. 1. Intravenous urogram demonstrating an enlarged liver shadow, within which are poorly defined areas of radiolucency. This was interpreted as being due to cirrhosis of the liver with fatty metamorphosis.

and often quite large lobules, are broad septa of richly cellular collagenous tissue. Within these septa are numbers of small bile ducts. Most of these ducts exhibit varying degrees of dilatation and tortuosity, an alteration which is associated with the presence of an unusual intraductal material. This material is granular, brightly eosinophilic, and only occasionally bile-stained. The bile-duct epi-

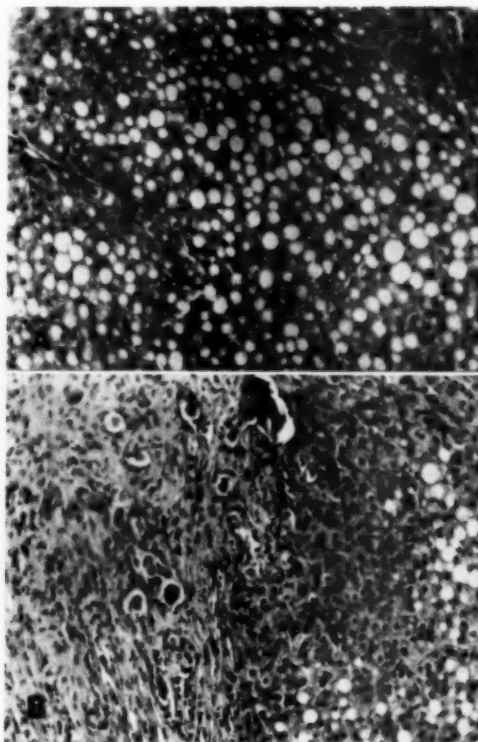


Fig. 2. A. Fatty metamorphosis of the liver. $\times c. 120$. B. Cirrhosis of the liver. Note small bile ducts filled with inspissated refractile material. $\times c. 120$.

thelium lining the involved radicles is considerably distorted and flattened. Occasionally it is completely desquamated, and here the duct lumen is lined by a ring of hyalinized connective tissue. Confined to the fibrous perilobular septa are moderate numbers of lymphocytes, plasma cells, and histiocytes.

"The central hepatic veins lack normal orientation both in relation to one another and to portal areas. An irregularity of the intervening hepatic cords and sinusoids is evident. Although varying in degree from lobule to lobule, the vast majority of hepatic parenchymal cells exhibit cytoplasmic accumulations of large fat vacuoles. The sparse glycogen present in these cells is compressed adjacent to the cell membrane, as is the eccentric nucleus. Hepatic cells immediately adjacent to the central veins and portal areas are generally spared this marked fatty alteration, being smaller, with the cytoplasmic glycogen normally dispersed. Hepatic sinusoids are collapsed, and no abnormality of the von Kupfer cells is evident." (Fig. 2)

DISCUSSION

Fibrocystic disease is a congenital con-

dition in which there is clinical evidence of the celiac syndrome resulting from pancreatic insufficiency, associated with severe pulmonary disease. The underlying abnormality is the production of thick, viscid secretions by the mucous-secreting glands of the body. These secretions may become inspissated to varying degrees and may produce an obstruction of the pancreatic acini and ducts, bronchi, intrahepatic biliary system, salivary glands, and the mucous glands of the esophagus, duodenum, jejunum, and gallbladder (1, 3).

The pulmonary manifestations are the result of emphysema or atelectasis, depending upon whether the bronchi are partially or completely occluded. As the disease progresses, the bronchi become dilated and thickened, and secondary infection occurs. Pulmonary fibrosis and chronic interstitial pneumonitis eventually develop. The celiac syndrome is the result of the obstruction of the pancreatic acini and ducts.

In patients with congenital fibrocystic disease, the liver frequently undergoes fatty metamorphosis. Farber found, in a small number of patients with the celiac syndrome, an unfamiliar type of cirrhosis of the liver which appeared to be secondary to intrahepatic biliary obstruction. In these cases, dilated small bile ducts, which reached a size many times the normal, were filled with a thick, inspissated eosinophilic material resembling that found in the pancreatic ducts and acini of the same patients. This material contained no bile pigment and consisted probably of mucoproteins elaborated by the lining cells of the greatly dilated bile ducts. Farber assumed that the inspissation of the mucoproteins in some of the finer intrahepatic bile ducts led to obstruction and dilatation of the ducts. Finally, atrophy of the parenchyma draining into these ducts was followed by replacement fibrosis and condensation of the stroma, which produced cirrhosis and distortion of hepatic structure (1).

Yesner and Kunkel (4) observed fatty

metamorphosis of the liver at the end of thirteen to twenty days of treatment with aureomycin. Furthermore, Lepper *et al.* have reported a diminution of liver function, following intravenous use of aureomycin, and clinical evidence of liver dysfunction in 7 patients who had received rather large doses of aureomycin orally and intravenously (2). They suggested that the pathological changes in the liver appeared to be reversible when the condition was recognized early and the medication was discontinued. The doses of aureomycin used in the case presented here were so small as to make it unlikely that the antibiotic played a role in the production of the liver changes found on biopsy. The pathological findings were consistent with those found by Farber (1) in some cases of congenital fibrocystic disease.

The roentgenograms of the abdomen in our patient showed multiple poorly defined areas of decreased density superimposed upon an enlarged liver shadow. These were interpreted as being due to the presence of large, irregular depots of fat or fatty tissue. The extent of fatty metamorphosis of the liver in cases of fibrocystic disease in early life, can be correlated roughly with the degree of atrophy and fibrosis present in the pancreas. Thus, advanced cases present an hepatomegaly in which there is a diffuse and uniform fatty metamorphosis of the parenchymal cells. In these cases a uniformity of liver density is present. This would render roentgenological demonstration of fat impossible, as such a demonstration depends upon contrasting densities within the organ. However, in those cases with superimposed cirrhosis secondary to "mucoviscidosis" of small intrahepatic bile ducts, this uniformity of fatty metamorphosis is lost. Not only does the fat content vary from lobule to lobule, but these lobules in turn are separated by wide septa of denser fibrous tissue. These factors combine to produce, in the liver tissues of varying density, a condition roentgenographically demonstrable.

SUMMARY

A case of cirrhosis of the liver with fatty metamorphosis, in which the diagnosis was originally made on interpretation of roentgenograms of the abdomen, is presented.

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SUMARIO

Descubrimiento Roentgenológico de Cirrosis Hepática con Metamorfosis Adiposa:
Presentación de un Caso Debido a Afección Fibroquística Congénita

Preséntase un caso de enfermedad fibroquística congénita con cirrosis hepática concomitante, en el cual se estableció el diagnóstico de cirrosis a base de la radiografía simple del abdomen. El diagnóstico de afección fibroquística se hizo por primera vez a la edad de tres semanas. Se descubrió la hepatomegalia cuando el niño

tenía unos tres años, y pocos meses después un examen subsiguiente reveló agrandamiento de la sombra del hígado y zonas esparcidas de radiolucencia por todo el órgano. Esas alteraciones fueron interpretadas como indicativas de cirrosis con metamorfosis adiposa asociada, confirmando el diagnóstico histopatológicamente.



Optimum Dosage Studies for Radiation Therapy of Carcinoma of the Uterine Cervix¹

JAMES F. NOLAN, M.D., and LUCILLE DuSAULT, A.B.

IN GENERAL, this essay will concern itself with the question of the importance of dosage concepts in radiation therapy for carcinoma of the uterine cervix. More specifically, the study represents an attempt to define an optimal dose or range of dosage for this disease. Admittedly, the whole subject is a large one. Although we cannot presume to offer a complete description of all the factors involved, the search of our own experience for this "golden mean" may be of interest to others.

While radiation therapy has scientific shading, it is essentially a form of medicine performed by physicians. As physicians we tend to be empiric in our desire to treat rather than to test. Explanations as to how results are obtained, although important to us, usually appear after the fact and are necessarily interpreted in the light of clinical experiences, good or bad. In training, when we have a minimum of clinical experience, it is natural to rely on a "scientific" approach and a critical appraisal of the results of others for a choice of treatment methods. As experience is gained, there is a tendency to revert to measures which have been found effective in our own hands and not to be too critical of the occasional poor result if the general rate of success remains adequate. As far as dosage concepts in radiation therapy for uterine cancer are concerned, they must be translated into treatment methods which will appreciably improve results to be clinically important to physicians.

There are, to be sure, factors other than the amount and type of treatment which will influence the clinical course of any malignant disease. These are physiologic in nature and, although they are not entirely uncontrollable, treatment directed toward them is of a secondary character.

Since dosage is the primary factor which may be controlled by the therapist, it remains of first importance.

To review briefly some of the fundamental ideas upon which treatment is based, we may state that the philosophy of "if one's good, two's better" does not apply in radiotherapy. The basic theory of the action of ionizing radiations in tissue is that all such radiations are traumatic and their effectiveness is a result of a differential recovery rate between normal and abnormal tissue. As far as the control of cancer is concerned, it is obvious that there should be a minimal amount of radiation below which tumor cells will not be destroyed. Conversely, there must also be a maximal dose above which the tissues of the tumor bed may be destroyed. Between these extremes lies the optimal dosage, which will allow for inhibition of the malignant growth without disruption of the normal resisting factors of the surrounding structures. Optimal dosage, then, is an ideal condition to be sought in all radiotherapy. In his Mackenzie Davidson Memorial Lecture, Dr. Ralston Paterson presented an excellent discussion of the subject, entitled "Studies in Optimum Dosage" (9). "Dosage" must be described in terms of its components, namely, (1) optimal dose or amount of radiation; (2) optimal time range over which this is delivered; (3) optimal volume of tissue to be exposed. Experience has shown that the amount of radiation tolerated by a small volume of tissue is much greater than that tolerated by a large volume. This may be a function of the uninjured tumor bed. As far as time is concerned, a large amount of radiation which will not be tolerated when given in a few days may be applied successfully in a

¹ From the Los Angeles Tumor Institute, Los Angeles, Calif. Presented before the Philadelphia Roentgen Ray Society, May 7, 1953. Accepted for publication in July 1953.

matter of four to six weeks. This effect might be a function of the differential rate of mitoses of the cells in the irradiated volume. As far as an optimum quantity or dose is concerned, this too might be variable, depending upon the physiologic characteristics of the tissue exposed.

The exposition of these basic radiotherapeutic principles, which are naturally complex, is confused, not only because of over-simplification in the need for brevity, but also because of inability to express them clearly. Suffice it to say that the best clinical results from radiotherapy must be a product of individualization to the specific problem within the limitations of these principles and the available sources of ionizing radiation.

Studies of optimal dosage for superficial epidermoid carcinoma in relation to skin recovery are certainly not new. Reports of this type have been made by Ellis (5), Cohen (1), Quimby (10), and Strandqvist (11). Actually, formulae have been derived which describe the median curative tumor dose in relation to time for such tumors. The variation among reported results of this type is not great, and it seems quite logical that the various measurable factors involved in such treatments should bear rather constant relationships. The "Strandqvist curve" has become a common convention in describing such relationships. The adaptation of this type of convention to data derived from study of patients treated for carcinoma of the uterine cervix is more difficult. The usual therapeutic methods, which involve both external x-ray irradiation and intracavitary radium application, make the definition of a "tumor dose" inaccurate because it is not uniform throughout the pelvis in relation to the possible extent of the tumor. Although the same principles must be pertinent, an optimal dose-time relationship must be described on the basis of maximal and minimal effects.

In past studies (3) of our own experience in relation to the influence of various biologic characteristics and dosage delivered

to the parametria in the treatment of carcinoma of the uterine cervix, we were impressed by what appeared to be overdosage effects. These were apparent as failures in the face of high dosage in early lesions, not explainable as the result of extragenital complications but manifest as local recurrence of the tumor. The explanation for this lies in the paradoxical concept of the "supralethal effect." This term originated in the British literature and describes a regrowth of tumor in an injured tumor bed as one result of excessive dosage. Although this effect may be present in treatment failure of advanced disease, it is usually overshadowed by under-treatment effects as the paramount feature. It is logical, therefore, to find overdosage effects evidenced only in early cases.

In order to explore these relationships, all pertinent data were obtained from the records of some 420 patients treated primarily at the Los Angeles Tumor Institute between the years 1933 and 1950. These included 216 Stage I and 204 Stage III cases. Their present status was evaluated and classified on the basis of clinical success or failure. Criteria for classification were based on factors which would demonstrate the effect of dose delivered rather than simple five-year survival. Patients dead with disease, lost with disease, or with recurrence at any time in the follow-up period were considered failures as far as the primary treatment was concerned. If the patient was lost or dead without disease in less than five years, the result was considered indeterminate, as the relationship between dose and result could not be evaluated. Clinical successes include only patients alive without disease throughout the follow-up period. Some patients have been followed less than five years, but in these a rate of failure similar to that for those followed over longer periods may be expected.

It was assumed that a maximal effect might be apparent from a study of Stage I treatment failures in relation to dosage

STAGE I: FAILURES

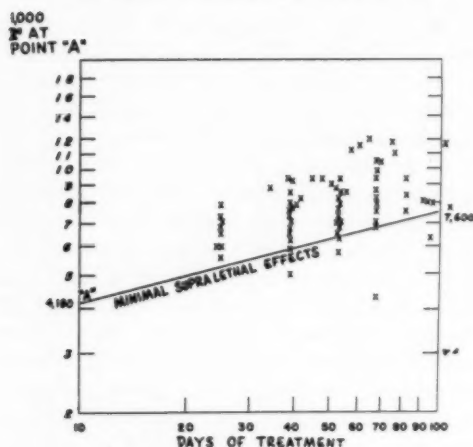


Figure 1

delivered to the proximal parametria at the point described in the literature as Point "A." From a study of the available data, it seemed that a line could be drawn which might show the beginning of a "supralethal effect." This extends from 4,180 r in ten days to 7,600 r in one hundred days (Fig. 1).

Since it was possible that this "minimal supralethal effect" line might be more apparent than real and merely represent an expression of the lowest doses given to this group of patients, the same line was drawn through the graph of Stage I successes plotted in the same manner (Fig. 2). While there was a preponderance of patients treated with doses above this line, there was a good distribution of successes beneath it. The percentage of successes was 88 per cent below the line, as compared to 65 per cent above. We believe, then, that any "supralethal effects" should begin to become apparent with doses above this level at Point "A," since in Stage I the disease is presumably medial to this point.

In studying "minimal cancerocidal dosage," Stage III patients were used. Here the disease has spread beyond Point "A" to the pelvic wall, and dosage as expressed in roentgens in that area becomes crucial.

The same type of graph as for the Stage I cases was used to plot Stage III successes, and a "minimal cancerocidal effect" line was drawn, beneath which adverse effects from under-dosage should appear. This extended from 2,000 r in ten days to 3,640 r in one hundred days, and the slope was similar to that of the previous curve (Fig. 3).

STAGE I: SUCCESSES

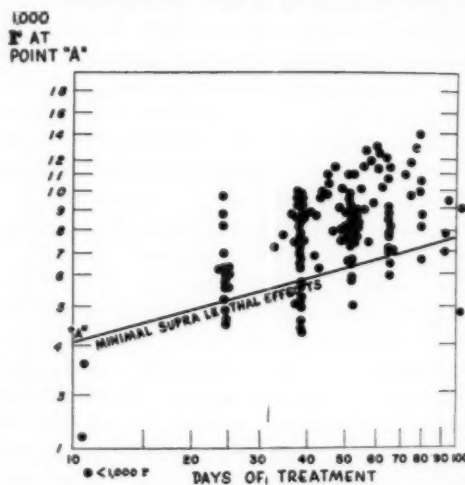


Figure 2

Again, to rule out the possibility that the result represented only the distribution of doses given, the same line was drawn through a plot of the Stage III failures (Fig. 4). This shows an adequate distribution of points on either side of the line, with a 10 per cent success rate below and 34 per cent above it. From this we hoped to show that beneficial effects from cancerocidal irradiation would begin to appear with dosages above this line.

In order to compare these results with others, the minimal effect lines were plotted with similar curves recently published by L. Cohen (1, 2) and some others obtained by us (4, 7). It was found that Cohen's median cancerocidal dose line for epidermoid carcinoma of the skin was similar in slope to the minimal effect lines (Fig. 5). The slope of the lines indicates the recovery rates of the tissues involved.

This similarity is not surprising, since all three curves refer to reactions in epidermoid carcinoma. The position of the median cancerocidal dose line approaches the minimal supralethal line, which also would be natural, since below this level the underdosage effects would probably outweigh the overdosage effects.

STAGE III: SUCCESSES

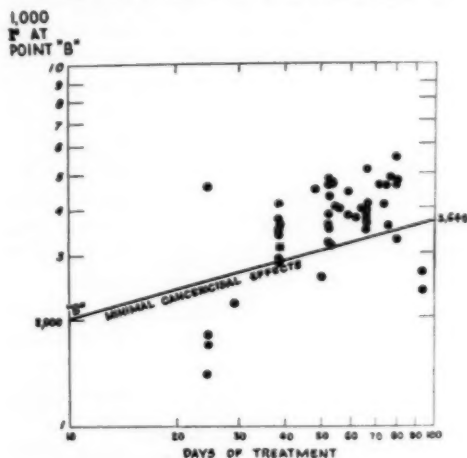


Figure 3

Cohen has also published a curve for the median cancerocidal tumor dose for adenocarcinoma of the breast. He pointed out that the position of the curve was beneath that published for epidermoid carcinoma and that this indicated a greater absolute radiosensitivity. He further stated that the steeper slope for adenocarcinoma indicated a faster recovery rate. A comparison of his curve for adenocarcinoma of the breast with ours for minimal cancerocidal dose at Point "C" for adenocarcinoma of the corpus uteri reveals again a remarkable similarity. Previously, we had drawn a minimal complications line for the dose at "A" in epidermoid carcinoma of the cervix. Since these complications were overwhelmingly gastrointestinal, it is logical that the slope of the curve would be similar to that found for glandular epithelium rather than for squamous epithelium. The curve is higher in posi-

STAGE III: FAILURES

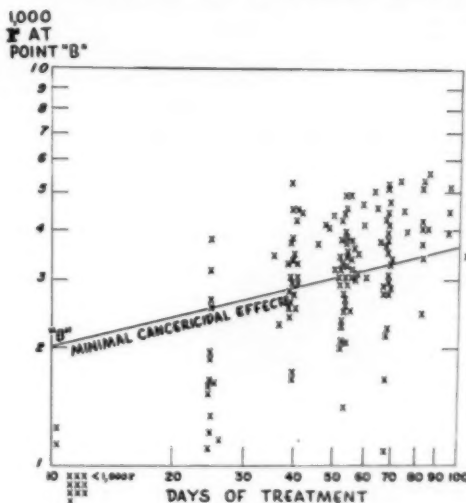


Figure 4

TIME DOSE RELATIONSHIP

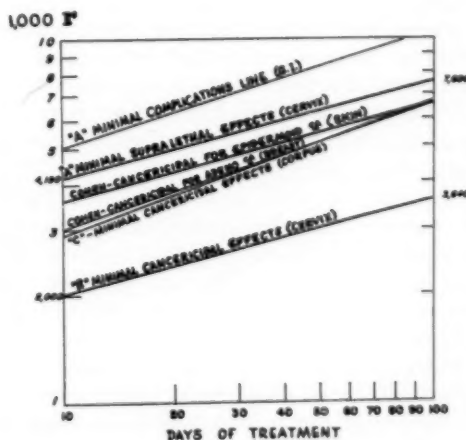


Figure 5

tion than those for cancerocidal effect because doses were calculated at the proximal parametrium rather than at the rectal mucosa.

Admittedly, these comparisons seemed too close to be true, and it was deemed advisable to test them further against our own data. The logical assumption would be that, if a uniform dose could be delivered

RELATIONSHIP OF % SUCCESS AT UNIT TIME OF 8 WKS.

FOR:

- ① STAGE III to Dose at "B"
- ② STAGE I to Dose at "A"

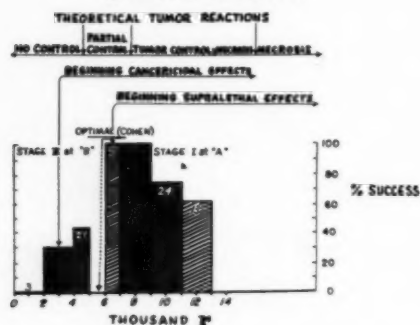


Figure 6

throughout the parametrium, there should be an optimum dose level which would show the highest percentage success rate and a normal distribution of decreasing successes above and below this level. As stated before, we could not demonstrate this type of distribution because the patients studied were not treated in a manner which would yield such a uniform dose. However, we were able to show in patients treated recently (1945-1950) a declining percentage success rate for increasing dose at Point "A" for Stage I cases, and an increasing percentage success rate for increasing dose at Point "B" for Stage III cases (Fig. 6). During this period a definite attempt was made to increase the dose at Point "B," despite the consequent increase in dose at Point "A." The calculated dosages for these patients were transposed to unit time of eight weeks, which was the average treatment time with the technic employed. On the graph are marked the minimal effects points and Cohen's optimal point, as derived and described earlier in this paper, also reduced to unit time of eight weeks. These are compared to theoretical levels of reaction to radiation which have been used in previous discussions (8). We cannot, of course, establish an optimum range of dosage from our present data, but this

comparison would indicate that it is probably $6,000 \text{ r} \pm 1,000 \text{ r}$ delivered in an eight-week period.

In his presentation at the St. Louis meeting of the American Radium Society, in 1953, Garcia (6) reported a study similar to this one. As far as time-dose relationship is concerned, Garcia's data yield comparable observations, in that a mean line through the successful treatments has a slope quite similar to the ones presented here. His dosage data were corrected for biologic effect rather than presented as an addition of x-ray and gamma roentgens. If, however, his line could be reduced to the same terms of added roentgens, it would probably be about $8,600 \text{ r}$ at "A" in eight weeks, which is consistent with the "minimal supralethal effects" point. Garcia also showed poorer results with high dosage to Point "B," due to high x-ray dosage. This was not seen in our data, perhaps because our dose levels at this point were not carried so high. However, the level of beginning adverse effects from high dosage at Point "B" may well be beneath that for similar effects from high dosage at Point "A" because of the greater volume of tissue involved.

In summary, it would seem that there probably is an optimal range of radiation dosage which, when delivered to the pelvis of patients treated for carcinoma of the uterine cervix, should result in a higher percentage of clinical success. We cannot deny that there may be other factors which may influence clinical outcome, but the controllable feature of the radiotherapy to be applied in any given case makes the search for this optimum range of dosage clinically important. The main difficulty lies in our inability to deliver such a dose by present treatment technic. At least, adaptation of present treatment methods to improve the uniformity of dosage distribution should be advantageous in avoiding points of overdosage as well as underdosage.

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SUMARIO

Estudios de la Dosis Optima para la Radioterapia del Carcinoma del Cuello Uterino

En estudios anteriores de la dosis entregada a los parametrios en el transcurso de la irradiación para el carcinoma cervical, observóse lo que parecía ser efectos de hiperdosis. Estos se manifestaban en forma de recurrencias locales y se explican a base de un efecto "supraletal." No se descubrieron más que en casos incipientes.

Para estudio ulterior de este punto, se repasaron los datos pertinentes en unas 420 enfermas con carcinoma de los Períodos 1 ó 3, justipreciándose el estado actual de las mismas a base de éxito o fracaso clínico. Las gráficas de los fracasos

y los éxitos indicaron que existe probablemente una escala óptima de irradiación que, llevada a la pelvis de las pacientes que tienen carcinoma del cuello uterino, debe producir un porcentaje más alto de éxitos clínicos. Aunque no cabe establecer esa escala posológica por los datos presentados, parece que es probablemente de 6,000 r \pm 1,000 r.

La adaptación de las actuales técnicas terapéuticas a fin de mejorar la distribución uniforme de la dosis debe resultar ventajosa para evitar puntos de hiperdosis así como de hipodosis.



Intravenous Cholelithography with a New Contrast Medium, "Cholografin"¹

T. L. ORLOFF, M.D., D. M. SKLAROFF, M.D., E. M. COHN, M.D., and J. GERSHON-COHEN, M.D.

IT IS NOW POSSIBLE to visualize the hepatic and common ducts in cholecystectomized patients by the intravenous use of a new preparation called "Cholografin"² (1). This compound is the disodium salt of N:N' adipic-di (3-amino-2:4:6-triiodophenylcarboxylic acid). It is prepared as a 20 per cent isotonic solution. The iodine content, 64.32 per cent, is firmly bound in the molecule and not split off after the substance is injected intravenously. The substance is actively excreted by the liver cells and appears in the bowel a few minutes after intravenous injection. The common duct fills within twenty minutes and can be demonstrated roentgenographically. In the presence of jaundice, however, the common duct is not visualized. Instead, the compound is excreted by the kidneys in sufficient concentration to produce good urograms.

Following cholecystectomy, symptoms may recur which resemble or are identical with those which existed prior to operation. These symptoms may appear shortly after surgery or may develop several months or years later.

The most common causes for persistence of symptoms following cholecystectomy are erroneous preoperative diagnosis, calculi in the biliary ducts, common duct stricture, stone or inflammation of the cystic duct remnant, adhesions involving the stomach or the duodenum, residual cholangitis, hepatitis and pancreatitis, removal of functioning gallbladder, biliary dyssynergia, and an unrecognized malignant lesion (7). The diagnosis of common duct stone in the post-cholecystectomy patient is not difficult when there are typical attacks of biliary colic followed



Fig. 1. Calculus in the common duct.

by jaundice, and sometimes chills and fever. The problem is less easily solved in many patients who have attacks simulating biliary colic in the absence of jaundice.

TECHNIC OF EXAMINATION

The examination is best carried out in the morning, and the patient must be fasting. A laxative, such as castor oil or compound licorice powder, may be given the night before the examination. During a period of six to ten minutes, 40 c.c. of a 20 per cent solution of the medium is injected intravenously. If the injection is

¹ From the Departments of Radiology and Gastroenterology, Albert Einstein Medical Center, Northern Division, Philadelphia, Penna. Read by title at the Thirty-ninth Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 13-18, 1953.

² This medium, introduced as "Biligradin" in Germany (2-6) in 1953, was given its present name, "Cholografin" by its American manufacturers, E. R. Squibb & Sons, New York, N. Y.

given too rapidly, some reaction may occur. Films made at twenty minutes after injection are viewed while wet, in order that exposure intervals and positioning of the patient may be changed if necessary. Correct positioning is important. Multiple film studies with different degrees of rotation in both the erect and recumbent positions and in the lateral decubitus are helpful in separating overlying ribs and



Fig. 2. Dilated cystic stump and common duct.

gas shadows from portions of the main hepatic and common ducts. For good contrast, 45 to 50 kv. and 400-800 mas. are used.

REACTIONS

If the tissues around the veins are injected inadvertently, local irritation will result. Slight nausea, dizziness, sneezing or restlessness occurred after injection in a few of our cases, but this was believed to have been due to rapid injection. Though we have not encountered any instances of severe reaction, we continue to perform routine intravenous tests for hypersensitivity (1 c.c. injected intravenously) before injecting the full dose of the contrast medium.

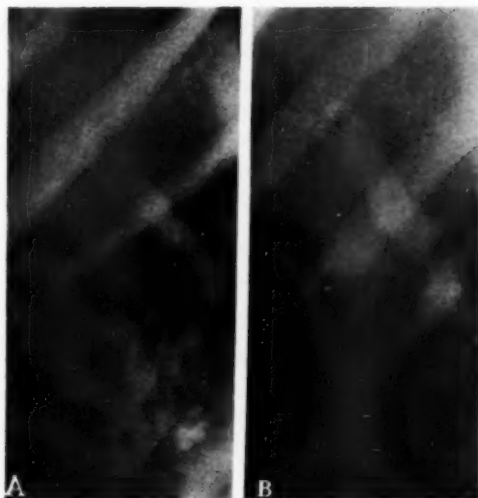


Fig. 3. Concentration of "Cholografin" in common duct (A) before and (B) after the intramuscular injection of 1/6 gr. morphine.

RESULTS

Thirty post-cholecystectomy cases have been examined to date, with visualization of the common duct in 26 and non-visualization in 4. Hyperbilirubinemia and/or lowered hepatic function were associated with the 4 cases of non-visualization. The use of Cholografin in cases with hyperbilirubinemia and/or lowered hepatic function, especially if associated with jaundice is therefore not recommended. Common duct calculi were visualized in 3 of the 30 post-cholecystectomy patients. Calculi in the common duct (Fig. 1) and dilated cystic stumps (Fig. 2) can be demonstrated with satisfactory effect.

Visualization of the minor hepatic radicles has been disappointing. The concentration of the Cholografin is apparently not sufficient for more complete demonstration of these minor hepatic branches. The main hepatic duct is always visualized simultaneously with the common duct. In cases of sphincteric relaxation, the concentration of Cholografin in the common duct can be improved with intramuscular injection of 1/6 gr. of morphine sulfate (Fig. 3).

SUMMARY

A new compound for intravenous cholecystography is described, called Cholografin. It reaches maximum concentration in the main hepatic and common ducts in about twenty minutes, permitting diagnosis of calculi in the common duct in the post-cholecystectomy syndrome.

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EDITORIAL NOTE: The original papers on this new medium are abstracted rather fully in this issue of RADIOLOGY (pp. 903-905).

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SUMARIO

La Coledocografía Intravenosa con un Nuevo Medio de Contraste, "Colografin"

Un nuevo medio de contraste, "Colografin," introducido primitivamente en Alemania como "Biligrafin," ha resultado útil para el descubrimiento de cálculos en el colédoco en el llamado síndrome postcolecistectómico. Este compuesto es la sal bisódica de N:N' adipin-di(ácido-3-amino-2:4:6-triyodofenilcarboxílico). Prepárase en forma de solución isotónica al 20 por ciento. A continuación de

la inyección endovenosa, el medio alcanza su concentración máxima en el conducto hepático y el colédoco en unos veinte minutos. Si existe ictericia, no se observa el colédoco, pero se excreta el compuesto por el riñón en cantidad suficiente para producir buenos urogramas. En los casos de relajación esfintérica, puede mejorarse la concentración en el colédoco con la inyección intramuscular de sulfato de morfina.



A New Approach to the Ulcer Problem: Irradiation of the Surgically Exposed Stomach

An Experimental Study¹

MATTHEW TALMADGE MOOREHEAD, M.D.

EXPERIMENTAL studies of a new method of treating peptic ulcer have been conducted. The method involves the use of both surgery and roentgen therapy. It is based on the assumption that proper irradiation of the surgically exposed stomach will not only drastically reduce gastric acidity and secretory activity but will also cause the healing of peptic ulcers and prevent their recurrence.

The etiology of peptic ulcer is still unsettled, but enough is known to indicate clearly the importance of acid corrosion (1-3). Indeed, some investigators predict that when a satisfactory method for permanently lowering gastric acidity can be found the ulcer problem will have been solved (3). Subtotal gastric resection (4-6) is one such method and has proved effective in the treatment of peptic ulcer, but it is not an infallible cure, and it is a major operative procedure that cannot be undertaken in some patients. All investigators agree that gastric acidity and secretory activity can be greatly reduced, temporarily at least, by roentgen irradiation (7-17), and it is felt that this field should be more thoroughly explored.

The word "peptic" is used as a convenient designation for three types of benign ulcer: gastric, duodenal, and jejunal (post-operative or marginal). We are not concerned here with gastric ulcer, since its well known relationship to cancer often makes resection imperative.

No record of the application of roentgen rays to the surgically exposed human stomach for the relief or prevention of

peptic ulcer has been found, nor could we discover any report of previous work of the type to be described here, namely, irradiation of the surgically exposed dog's stomach combined with the experimental induction of ulcers, as by the Mann-Williamson procedure (11). Ivy (7) in 1923, Portis and Ahrens (8) in 1924, Dawson (9) in 1925, and Snell and Bollman (12) in 1934 tried irradiation of the dog's stomach without the induction of ulcers, and all observed significant reduction in acidity and secretory activity, if not actual achylia, but these effects were not always permanent. Jenkins (10), in 1942, tried irradiation of the intact human stomach with radium and obtained a virtually permanent reduction in gastric acidity. Most subsequent reports on radiotherapy deal with the clinical use of roentgen rays directed toward the stomach through an intact abdominal wall (13-17). In work of the latter type it is obviously impossible to separate satisfactorily the gastric effects from the concomitant and confusing effects of irradiation on adjacent sensitive organs such as the liver, adrenals, pancreas, spleen, and small intestine. Here it is suggested that the abdomen first be opened and the rays carefully directed to the stomach alone.

Mann and Williamson (11) in 1922, devised an operative technic for inducing peptic ulcers with great regularity in dogs (Figs. 1 and 2). The successive steps in this procedure are: transection of the stomach at the pylorus; closure of the

¹ From the Graduate School of Medicine of the University of Pennsylvania and the University of Vermont, Departments of Surgery. Accepted for publication in July 1953.

Condensed from a Thesis which was approved by the Faculty of the Graduate School of Medicine of the University of Pennsylvania, as partial fulfillment of the requirements for the degree of Master of Medical Science (M.Sc. (Med.)) for graduate work in Surgery.

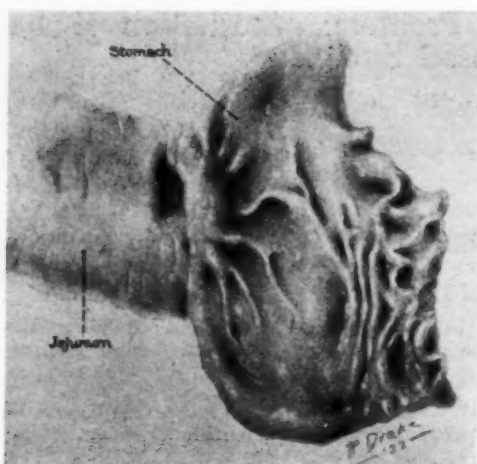


Fig. 1. Typical Mann-Williamson ulcer in the dog (Markowitz).

upper end of the duodenum; transection of the jejunum near the ligament of Treitz; anastomosis of the distal end of the transected jejunum to the open end of the stomach; and finally anastomosis of the proximal end of the jejunum, together with the attached duodenum, to a loop of terminal ileum (Fig. 2). The procedure causes unneutralized gastric juice to flow directly over unprotected jejunal mucosa, and in virtually every instance peptic ulceration appears quite promptly at or just beyond the line of anastomosis. Ulcers induced in this manner are said to be "indistinguishable" from the ordinary clinical variety in man (3). They are of serious nature, progressing usually to a lethal termination either by perforation or hemorrhage (3, 8). Mann and Williamson reported "typical" ulcers in 95 per cent of their dogs, while most subsequent investigators obtained ulcers in higher percentages; in our laboratory the percentage was 100.

A consideration of the selectively destructive nature of roentgen rays (18-20) is germane. Certain tissues of the human body may be readily destroyed by amounts of irradiation that leave other tissues little altered (19), the differences in radiosensitivity being rather large (20). In order of their sensitivity, the various tissues

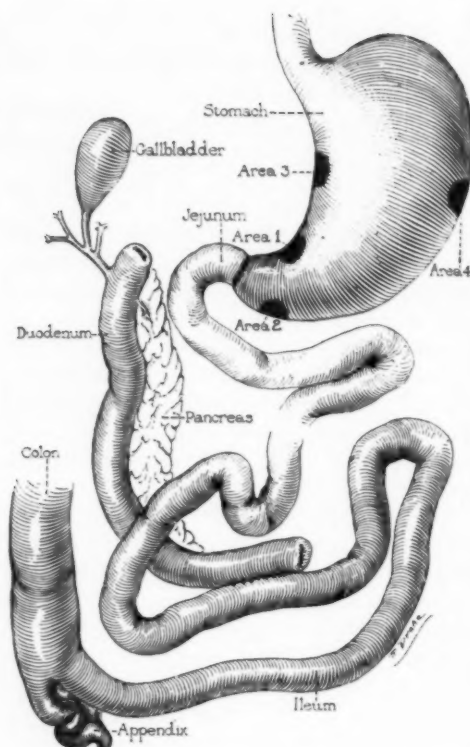


Fig. 2. A completed Mann-Williamson operation for inducing peptic ulcer. (From Morton: *Ann. Surg.* 85: 213, 1927)

may be arranged as follows (18). 1. Lymphocytes. 2. Leukocytes. 3. Basal epithelium: (a) secretory glands, (b) gonads, (c) skin, stomach, and intestine, (d) lip, liver, etc. 4. Endothelium. 5. Connective tissue. 6. Muscle. 7. Bone. 8. Nerves. From this listing it is apparent that a dosage of x-rays might well be found which, in theory at least, would destroy the gastric mucosal epithelium while causing little damage to the more resistant cells of the deeper tunics. The following experiments seem to justify this assumption.

Twenty-six operations were performed on 18 mongrel dogs. Four were reserved as controls on the Mann-Williamson operation and 3 as controls on the gastric irradiation. In all of the Mann-Williamson controls, as anticipated, severe marginal (jejunal) peptic ulcers appeared quite

promptly, followed by death within three weeks from the effect of this ulceration. The 3 irradiation-control dogs showed only minor gastric changes, and none died. The stomachs of the remaining 11 dogs were openly irradiated at the time of, or prior to, the performance of Mann-Williamson operations, and the combined effects of these two procedures were studied chiefly by necropsies but also by clinical observations and laboratory examinations. The survival periods were from two to eight weeks. At necropsy, in each case, photographs and photomicrographs were made, but space limitations prevent their reproduction here.

A surgical technic similar to that used in the operating room of a modern hospital was employed. The operation was at first done in two or three stages but later a one-stage technic was devised. When irradiation alone had been planned, a segment of stomach was delivered through the incision, shielded with lead, and irradiated. When a combined operation had been planned, irradiation of the delivered stomach was carried out first and immediately thereafter a Mann-Williamson operation was performed. An open technic of anastomosis was used.

X-rays were directed horizontally through the delivered segment of stomach, half right and half left, thus affording additional protection. Roentgen factors employed were as follows: 6 ma.; 6 in. (15.24 cm.) anode-stomach distance; 0 to 0.5 mm. aluminum filtration. The dosages, measured in air, were 1,400 to 3,000 r, given at the rate of 240 to 434 r per minute. A modern type of portable therapy machine (140 kv.p.) was used, but a peak kilovoltage of 100 was elected. It was soon found that irradiation of the entire stomach was not only difficult but apparently unnecessary; one half seemed adequate for the duration of these experiments. A representative protocol from the Mann-Williamson irradiation group of 11 dogs is presented. (All studies of gastric acidity and peptic activity have been omitted for brevity.)

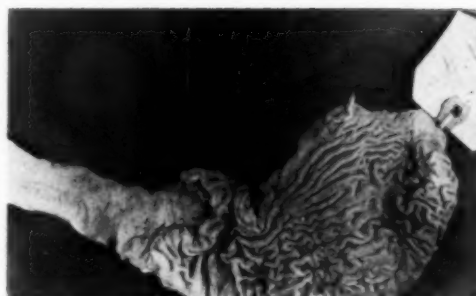


Fig. 3. Stomach and intestine of dog No. 14, showing absence of ulcers following a Mann-Williamson operation and irradiation of the exposed stomach.

Dog No. 14: The delivered stomach was irradiated (1,880 r) and at the same time (May 31, 1946) a Mann-Williamson operation was performed. Recovery was rapid and the animal appeared to be in good condition at the end of almost eight weeks, when it was accidentally sacrificed (July 25, 1946). At necropsy the anastomoses were found in excellent condition and no ulcers were present (Fig. 3). There was no distention and no peritonitis. The lower half of the stomach (irradiated zone) was somewhat shrunken and contracted in appearance and there was considerable roughening of the serosal surfaces, with scattered adhesions, but the mucosa of the entire stomach and intestine appeared grossly normal. Histologic studies from the stomach of this animal, as well as the remaining 10 of this group, seemed to indicate that irradiation had selectively destroyed or altered the glandular cells of the gastric mucosa to such an extent that the gastric juice was no longer corrosive or irritating to the mucosa of the jejunum.

SUMMARY

A technic of roentgen irradiation of the surgically exposed stomach was tried in an attempt to reduce gastric secretory activity (acidity) and thereby prevent the appearance of experimentally induced ulcers. Twenty-six operations were performed on 18 dogs. Seven animals were reserved as controls. In 11 both irradiation of the exposed stomach (1,400 to 3,000 r) and the ulcer-inducing procedure (Mann-Williamson) were done. In none of the 11 dogs did an ulcer develop.

For the duration of these experiments roentgen irradiation of a segment of the surgically-exposed stomach proved to be an effective method of preventing peptic ulcers of the Mann-Williamson type. Ir-

radiation in proper dosage seemed to destroy chiefly the secretory epithelium of the gastric mucosa, leaving other tissues and tunics of the gastric wall in relatively good condition.

ADDENDUM

Since this paper was first written, two clinical cases of intractable duodenal ulcer in man have been treated by a modification of the technic described above. One of these patients, a white male, age thirty-five years, is now in excellent physical condition more than four years after treatment (in 1948) and has had no recurrence of his former ulcer symptoms, which included repeated severe hemorrhages.

The second patient was treated more recently and is now in good condition, but the postoperative period has been too short to be of significance.

NOTE: The author wishes to express his appreciation to the Departments of Surgery, Radiology and Pathology of the University of Vermont for their cooperation and encouragement in this project, without which it would have been impossible (21, 22).

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Hawthorne, Calif.

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SUMARIO

Nuevo Aborde al Problema de la Ulcera: Irradiacion del Estómago Exteriorizado Quirúrgicamente

Tratando de reducir la actividad secretoria (acidez) del estómago y de impedir así la aparición de úlceras provocadas experimentalmente, probóse una técnica de irradiación roentgenológica del estómago puesto quirúrgicamente al descubierto. Ejecutáronse 26 operaciones en 18 perros. Se retuvieron 7 animales como testigos. En 11, se llevaron a cabo tanto la irradia-

ción del estómago expuesto (1,400 a 3,000 r) como el procedimiento provocativo de úlcera (Mann-Williamson), sin que en ninguno se presentara úlcera.

La irradiación roentgen de un segmento del estómago exteriorizado quirúrgicamente resultó ser, pues, un método eficaz para impedir las úlceras pépticas del tipo de Mann-Williamson.

EDITORIAL

So You Are Going to Present a Scientific Paper

Speaking in public is an art which few physicians have the time to master. This discussion is directed to most of us, who on occasion have started for the platform to deliver a paper before a medical or lay audience with no preparation except the notes or manuscript in our hands. From the standpoint of education, entertainment, and personal promotion, this may be a catastrophe.

In a scientific meeting, like it or not, people will not listen to you unless you can catch and hold their interest. For this reason, the presentation of a scientific paper is in some respects a show, and details of showmanship must be exploited. The nourishing of a stream of interest in an audience requires the use of "props"—usually lantern slides, occasionally models or exhibits—in which must be combined the unexpected, the pleasing, and the familiar with a slight variation. In this material, color, composition, and lighting (or ease of viewing) are of first importance. Of the actor, more later.

Now, consider for a moment the long-suffering audience. Up until a moment ago, when your name was announced and you strode upon the boards, you were the audience. Had you perhaps been bored by previous speakers, annoyed by their mannerisms, confused by their methods of presenting facts? If you can remain a member of the audience, consciously, while you are on the stage, your talk will be a success; otherwise it may be something less.

The timing of your paper is crucial. You *must* finish before the deadline. This requires frequent practice runs with watch in hand before the bathroom mirror. When engaged in this exercise, speak slowly and remember to subtract several

minutes from your allotted time for unexpected contingencies. There are only two reasons which cause a speaker to exceed his prescribed time. One is the feeling that anything he says must be important to others. This is the intoxicated-with-the-sound-of-his-own-voice fellow. The other is the fear of omitting some detail which will clinch the argument or bring in reluctant converts. This is the chap who does not understand that the word "scientific" refers to his paper but not the audience. It is a sound rule never to say all you know, and to retire while your listeners are hoping for more. They will ask you again. If you are allotted twenty minutes, speak for seventeen minutes and sit down. You will be astonished at the applause.

The subject matter or content of your talk must be limited by the time at your disposal. The journalistic approach is a successful one. Talk in headlines, with just enough "copy" or explanation after each to make the main thought clear. Be simple in concept, terse in expression, and logical in progress from one idea to the next. The tabloid newspapers get a message across to each reader with a minimum expenditure of his time and effort; a *Times* requires the leisure of a Sunday afternoon.

To put it another way, the most important points in your talk are the idea or thesis you wish to develop, the major evidence supporting your opinions, and your conclusions. A twenty-minute paper requires self-discipline and sharp editing. The story is told of a famous medical man who was invited to speak for twenty minutes upon a subject in which he was an expert. He refused, because he said the six weeks allotted to him for preparation

were much too short, although he could talk for an hour on the same subject, tomorrow.

Finally, do not read directly from a manuscript. It is bad showmanship. Furthermore, your paper as written for publication may well be too long for a twenty-minute presentation. Since few of us can do justice to a scientific subject by presenting it without the help of notes, the most satisfactory arrangement is to have an outline of what you wish to say in topical form, with key words to keep your train of thought on schedule.

Lantern slides should be of standard size with the subject matter surrounded by a mat with a $2\frac{1}{2} \times 3$ -inch opening. This will insure that the whole slide will be projected upon the screen. If roentgenograms have been used to prepare the slide, they should be cropped beforehand so that the area of interest is magnified as much as possible, and only enough of the anatomy included for proper orientation. Above all, clean your slides carefully beforehand, and insist that they be handled only at the thumb star corner. Fly-specks and thumb prints have no place on the program of a medical assembly. Know your slides and be certain they are in the proper order and easy for the projectionist to keep that way. The agony of the misplaced slide is too much for most of us to bear.

Remember that it is impossible to use slides properly in a talk if they are projected faster than one per minute. Actually it is much wiser to allow two minutes per slide. In preparation, after you think you have the proper number to show in the time allotted, discard two or three more. Never use manuscript slides, and never insult your audience by reading the material on a slide. If it can't be read quickly by anyone in the back of the hall, throw the slide away.

When tables are projected from slides, they should be kept simple. No table should include more than four headings across and four down. Any complicated table summarizing results of experiments or clinical experience can be broken down

into several simple tables, each of which illustrates one major point.

Now for the bugbear of all amateur orators, the public address system. The two fundamental rules to remember are: always keep your mouth a fixed distance from the microphone, and avoid marked variation in pitch and inflection of your voice. The correct distance is 7 to 10 inches, and one must face directly toward the instrument, which should be slightly below chin level. When showing lantern slides, the speaker may turn and view the slide in silence, to remind himself of its contents, but must always return and face the microphone when discussing the material illustrated. Since all modulations in voice are amplified by the public address system, be conversational instead of rhetorical. Finally, do not kill your sentences by dropping your voice at the end of them. If a sentence is well constructed and states an essential fact, every word in it should be heard. To speak clearly, it is necessary to speak slowly, much more slowly than is your usual custom. This, of course, takes up more time, so cut your presentation and slides again.

Lastly, the actor himself. Do you develop nervous habits or mannerisms when facing a large audience? Most of us do. The best way to control your hands is to clasp them tightly behind your back, for the duration, or grasp each edge of the lectern firmly, and keep them there. Remember the "ahs" and "ums" between the words of previous speakers which distressed you as a member of the audience? Avoid them in your turn. The hesitating delivery, the groping for the right word, can be overcome only by repeated practice beforehand. After you have rehearsed your presentation alone, with watch in hand, several times, try it on one of your friends or colleagues, or even your wife. If you choose the right critic, you will be helped considerably by his reaction, even if it be a bit jaundiced.

Some of us talk well before small groups of people but are practically mute in a large hall containing 1,500 persons. In

this situation, it helps if the speaker can force himself to think of the audience as a group of friends anxious to hear what he has to say. This spurious assumption might actually become a reality, if clung to with enough faith.

Finally, nothing is more attractive than a speaker with conviction. If you believe earnestly in what you are saying, and show a thorough knowledge of your subject, you will command respect—*providing only that you stop on time!*

So you are going to present a scientific paper! You have a privilege and a responsibility to others far beyond any per-

sonal satisfaction gained by your opportunity. I commend to your careful study the references below. To you, personally, belongs the old Roman salute—"Hail and farewell!"

ROBERT P. BARDEN, M.D.

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ANNOUNCEMENTS AND BOOK REVIEWS

AMERICAN RADIUM SOCIETY

The newly elected officers of the American Radium Society are: John E. Wirth, M.D., Pasadena, Calif., President; Grant H. Beckstrand, M.D., Long Beach, Calif., President-Elect; Norman A. McCormick, M.D., Windsor, Ontario, First Vice-President; W. Edward Chamberlain, M.D., Philadelphia, Penna., Second Vice-President; Robert E. Fricke, M.D., Mayo Clinic, Rochester, Minn., Secretary; Douglas J. Roberts, M.D., Hartford, Conn., Treasurer. Members of the Executive Committee are: Howard B. Hunt, M.D., Omaha, Nebr., Chairman; Hugh F. Hare, M.D., Los Angeles, Calif.; Edith H. Quimby, D.Sc., New York, N. Y.

The next Annual Meeting of the Society will be held April 21-23, 1955, at the Shoreham Hotel, Washington, D. C.

FLORIDA RADIOLOGICAL SOCIETY

At the April 1954 meeting of the Florida Radiological Society, Dr. A. Judson Graves, of Jacksonville, was elected President; Dr. H. G. Reaves, of Sarasota, Vice-President; Dr. James T. Shelden, Box 1021, Lakeland, Secretary.

INDIANA ROENTGEN SOCIETY

The newly elected officers of the Indiana Roentgen Society are C. H. Warfield, M.D., of Fort Wayne, President; G. W. Rittman, M.D., Columbus, Vice-President; John A. Robb, M.D., 238 Hume-Mansur Building, Indianapolis 4, Secretary-Treasurer. The Society meets twice annually, on the first Sunday in May and during the fall meeting of the State Medical Association.

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY

The Mid-Summer Conference of the Rocky Mountain Radiological Society will be held at the Shirley-Savoy Hotel, Denver, Aug. 19-21. Guest speakers will be Dr. T. Leucutia, of Detroit, Mich., Dr. Eugene P. Pendergrass, of Philadelphia, Penna., Dr. Leo G. Rigler, of Minneapolis, Minn., and Dr. Charles Sherwood, of Rochester, N. Y.

EIGHTH ANNUAL CANCER SYMPOSIUM M. D. ANDERSON HOSPITAL

The Eighth Annual Symposium on Fundamental Cancer Research, sponsored jointly by the M. D. Anderson Hospital, the Tissue Culture Association, South Central Region College of American Pathologists, Texas Society of Pathologists, Houston Society of Pathologists, and the University of Texas

Postgraduate School of Medicine, was held April 5 and 6, at the M. D. Anderson Hospital, Houston.

Dr. Peyton Rous, emeritus member of the Department of Pathology and Bacteriology of the Rockefeller Institute of Medical Research, delivered the annual Bertner Lecture and received the Bertner Foundation Award for his outstanding contributions to cancer research.

A feature of the Symposium was a pathologic and radiologic conference on Tumors of Infancy and Childhood, conducted by Dr. Edith Potter of Chicago and Dr. Frederic N. Silverman of Cincinnati.

BIOLOGICAL PHOTOGRAPHIC ASSOCIATION

The Twenty-fourth Annual Convention of the Biological Photographic Association will be held Aug. 25-27, at the Hotel Chalfonte-Haddon Hall, Atlantic City, N. J. For further information, address Allen F. Hancock, Photo Unit, Jefferson Hospital, Philadelphia 7, Penna.

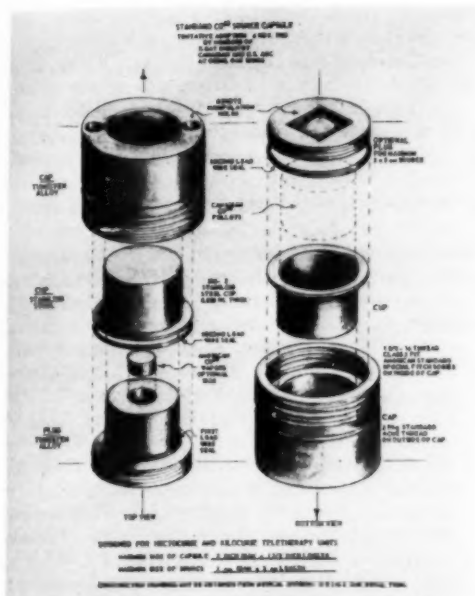
A STANDARD COBALT 60 TELETHERAPY SOURCE CAPSULE

As a result of a meeting, in October 1953, of representatives from fourteen x-ray equipment manufacturers with the Isotopes Division of the U. S. Atomic Energy Commission, Atomic Energy of Canada, Ltd., Oak Ridge National Laboratory, and the Medical Division of the Oak Ridge Institute of Nuclear Studies, there has been designed a standard source capsule for cobalt 60 teletherapy, as shown in the accompanying figure.

This capsule is adaptable to the various cobalt sources projected for use in Canada and the United States. On the basis of material with a specific activity of 50 curies/gram, which is now obtainable, it accommodates a total activity or more than 4,000 curies of cobalt 60. Tungsten alloy completely surrounds the source except in the direction of the primary beam, where a wide forward shoulder affords maximum shielding.

Airtight seals are provided. The design is suitable for methods of loading practiced in the United States and Canada. Manipulation and positioning are possible without application of pressure to the movable and critical parts. The only part that need be handled by remote control equipment is the solid outer cap. The radiation window consists of a 0.02-inch cover of stainless steel, which is regarded as the best compromise between strength and beam attenuation.

Some teletherapy machines will hold the source capsule in place by mechanical pressure, some will use a screw thread, and some will have a simple shelf arrangement. One design has visualized the capsule as a free floating bearing. The present design



allows any of these methods of emplacement. The standardization of a capsule for all sources of cobalt 60 of all sizes and curiages will allow each one to be transferred in its capsule from a high-intensity to a low-intensity machine with merely a handling charge.

During the next two years there will be an extensive study of the experience with the present standard source capsule, and late in 1955 the problem of a standardized source capsule will be reviewed by the entire industry.

CARL DARNELL

RADIOLOGY is happy to congratulate Mr. Carl Darnell on the celebration of his eightieth birthday, May 23, 1954. Mr. Darnell is widely known in the medical profession, and more especially in the field of radiology, having long held the post of commercial engineer with the X-ray Department of the General Electric Company. He retired in 1946 after twenty-nine years of service with the company.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

ADVANCES IN CANCER RESEARCH. Edited by JESSE P. GREENSTEIN, National Cancer Institute, U. S. Public Health Service, Bethesda, Md., and ALEXANDER HADDOW, Chester Beatty Research Institute, Royal Cancer Hospital, London, Eng-

land. Vol. II. A volume of 530 pages with numerous graphs and tables. Published by Academic Press, Inc., New York, N. Y., 1954. Price \$11.00.

THE FUNDAMENTALS OF X-RAY AND RADIUM PHYSICS. By JOSEPH SELMAN, M.D., Director, School for X-Ray Technicians, Tyler Junior College; Chief of Radiology, Mother Frances Hospital; Director, Radiology Department, Medical Center Hospital; Consultant in Radiology, East Texas Tuberculosis Hospital, Tyler, Texas. A volume of 340 pages, with 174 illustrations and 8 tables. Published by Charles C Thomas, Springfield, Ill., 1954. Price \$8.50.

PHYSICAL AND CHEMICAL ASPECTS OF BASIC MECHANISMS IN RADIOBIOLOGY. Proceedings of an Informal Conference Held at Highland Park, Ill., May 7-9, 1953. Edited by JOHN L. MAGEE, MARTIN D. KAMEN, and ROBERT L. PLATZMAN. Washington, D. C., National Research Council, 1953. A paper-bound volume of 146 pages. Price \$1.00.

CANCER OF THE LUNG (ENDEMIOLGY). A SYMPOSIUM. Edited by DOCTOR JOHS. CLEMMESSEN. Reprinted from ACTA Unionis Internationalis contra Cancrum (Prof. J. H. Maisin, Editor). A volume of 210 pages containing numerous tables and graphs. Published by the Council for International Organizations of Medical Sciences, Paris, 1954. Price \$6.00.

TRANSACTIONS OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY. Eighty-Ninth Annual Meeting, Hot Springs, Virginia, 1953. Vol. LI. A volume of 794 pages with numerous illustrations and tables. Published for the American Ophthalmological Society by Columbia University Press, New York, 1954. Price \$18.00.

ENCYCLOPÉDIE ÉLECTRO-RADIOLOGIQUE: RADIO-
DIAGNOSTIC, TOME IV. TUBE DIGESTIF-FOIE-
RATE-PANCREAS. Published under the Direction
of ROBERT COLIEZ, Médecin Electroradiologist des
Hôpitaux de Paris. A loose-leaf volume of the
Encyclopédie Médico-Chirurgicale, with a large
number of roentgenograms and drawings. Printed
in France, 18, rue de Seguer, Paris, 6^e, 1954.

Book Reviews

DIE TELEKÖNTGENTHERAPIE. By PROF. DR. W. TESCHENDORF, Köln. A monograph of 72 pages, with 8 illustrations. Published by Georg Thieme. Stuttgart, 1953. Agents for U. S. A., Intercontinental Medical Book Corporation, New York, N. Y. Price DM 8.70.

This small monograph on teleroentgentherapy takes up in turn the theoretical aspects and the practical applications of this mode of treatment.

The author points out that this technic is applicable to the entire body, the entire torso, or to a major region of the body. For uniform treatment of large areas in a single application, it is necessary that the field size be less than half the target-skin distance. Even with standing patients, sufficient distance may be difficult to obtain. It is recommended that the tube be directed downward, at least 2 meters above the floor, that the field size be determined by observation of the fluorescence of open cassettes upon the floor, and that the floor, upon which the patient is to lie, be then permanently marked for positioning.

Whole-body irradiation is not used for purposes of cell destruction in the same sense as conventional deep therapy. In both the mouse and the guinea-pig 600 r yields death in three to four days. At this dosage level, the reticulo-endothelial system is most sensitive, particularly the Kupffer cells of the liver, the reticulum cells of the spleen, and the capillary epithelium of the bone marrow. But, while a single 600 r dose is fatal, a guinea-pig can tolerate up to 6,000 r if it is fractionated at 10 to 25 r per day.

Just as the greater the fractionation, the greater the tolerance of the organism, so must be the greater the tolerance of a cancer cell. With very small doses, no cellular destruction can be seen. Nevertheless, some tumors do disappear and reduction in size has been observed with a total dose of 300 r fractionated over twenty days. Whatever the cause, a direct cancerocidal effect is out of the question.

The limiting factor in teleroentgentherapy is the blood, in which changes are detectable on as little as 5 r per week. Thrombocytes are very sensitive; radiation must be stopped should they drop below 100,000. Erythrocyte counts usually fall, although an occasional cancer victim will show an improvement in anemia. In myelophthisic anemia, both red and white counts fall so alarmingly that the least irradiation is dangerous. Of the blood elements, the white cells are affected the least. With the white cell count for control, one should never permit a drop below 3,000.

Most cases of polycythemia vera react favorably to whole-body irradiation, particularly if the spleen is still small. With lead shielding of the eyes and testes, 5 r is administered daily, alternately front and back, for one week. The erythrocyte count is followed weekly, keeping in mind that the greatest effect will be seen only after two to three months.

Leukemic cells are very radiosensitive. One begins with 3 r the first week in order to gauge the response. If necessary the dose may be raised to 5 r every three days. Since leukemia is a generalized disease it is almost senseless to shield any part of the body. In myeloid leukemia the splenic tumor will slowly disappear under teletherapy. There is no objection in selected cases to supplemental treatment of the spleen with 100 r through one or two ports. Whole-body irradiation is the method of choice in lymphatic leukemia. Local therapy to

enlarged lymph nodes does little good and should be undertaken only when anemia is so severe that general therapy is out of the question. Better, if at all feasible, is combined local and general irradiation.

Teleroentgentherapy may also be utilized, alone and in conjunction with other types of treatment, in Hodgkin's disease, lymphosarcoma, mycosis fungoides, and widespread tumor metastases. Principles similar to those given hold throughout.

TRATADO DE RADIOLOGÍA. By DR. S. DI RIENZO, Honorary Member of the German Society of Radiology, the American College of Radiology, the Spanish and Austrian Radiological Societies, Foreign Corresponding Member of the French Society of Radiology; DR. L. G. MOSCA, Corresponding Member of the German Society of Radiology and of the Austrian Radiological Society, Honorary Member of the Radiological Society of Brazil, Foreign Corresponding Member of the French Society of Radiology; and DR. J. I. ZORRILLA, Honorary Member of the Radiological Society of Panama, Instructor in the Escuela Privada de Radiología. A volume of 664 pages, with 707 illustrations. Córdoba (Rep. Argentina), Editorial Assandri, 1953.

The authors have dedicated this attractive book to the pioneers of South American radiology: Manoel de Abreu, Arrieta Sanchez, the late Pedro Barcia, Quirino Codas Thompson, Alfonso Esguerra Gomez and Gonzalo Esguerra Gomez, the late Pedro L. Fariñas, Erick Hegewaldt, Alfredo Lanari, and Oscar Soto.

This work grew out of a project for the teaching of radiology to physicians desiring training in the specialty. In order to make the training adequate, it became appropriate to start a primary school of radiology "for teaching the A, B, C's of the subject." To do this, it was necessary to step down from the chair of professor and assume the role of instructor. The authors found the task easy at the start, but difficult as it progressed. It was found that it is sometimes more difficult to teach simple things than the more complex. It was necessary to combine efforts of the instructors to unify problems and to found a school of basic radiology of sufficient authority to meet the challenge of the student disposed to learn. Thus was initiated the Escuela Privada de Radiología in Córdoba.

It also became important to provide a textbook, and thus began the preparation of the text represented in the volume reviewed here. Other more voluminous and more comprehensive treatises in the Spanish language have appeared in the Argentine but for a concise, clear, well ordered, well illustrated, well printed text for the student of radiology, this work is almost ideal. It has the added advantage of including a number of diagnostic innovations peculiar to the Córdoba group. A fifty-page section on radiotherapy concludes this excellent volume.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, Robert E. Fricke, M.D., Mayo Clinic, Rochester, Minn.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Exec. Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago 37.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. A. Meadows, Jr., M.D., Medical Arts Bldg., Birmingham 5.

Arizona

ARIZONA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. Lee Foster, M.D., 507 Professional Bldg., Phoenix. Annual meeting with State Medical Association; interim meeting in December.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, H. R. Morris, M.D., 1027 D St., San Bernardino.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, George Jacobson, M.D., Box 146, 1200 N. State St., Los Angeles 33. Meets monthly, second Wednesday, Los Angeles County Medical Association Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, H. B. Stewart, Jr., M.D., 2920 Capitol Ave., Sacramento. Meets last Monday of each month, September to May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually at time of California State Medical Association convention.

RADIOLOGICAL SOCIETY OF SOUTHERN CALIFORNIA. *Secretary-Treasurer*, George Jacobson, M.D., Box 146, 1200 N. State St., Los Angeles 33.

SAN DIEGO RADIOLOGICAL SOCIETY. *Secretary*, C. W. Bruner, M.D., 2456 Fourth Ave., San Diego 1. Meets first Wednesday of each month.

SAN FRANCISCO RADIOLOGICAL SOCIETY. *Secretary*, I. J. Miller, M.D., 2680 Ocean Ave., San Francisco 27. Meets quarterly, at the University Club.

SOUTH BAY RADIOLOGICAL SOCIETY. *Secretary*, James J. McCort, M.D., Santa Clara County Hospital, San Jose-Los Gatos Road, San Jose. Meets monthly, second Wednesday.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Wm. W. Saunders, M.D., VA Hospital, San Francisco 21. Meets third Thursday at 7:45, Lane Hall, Stanford University Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Parker Allen, M.D., Children's Hospital, Denver. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary-Treasurer*, William A. Goodrich, M.D., 85 Jefferson St., Hartford 14. Meets bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, B. Bruce Alicandri, M.D., 20 Maple St., Springfield, Mass. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, Alvin C. Wyman, M.D., 5445 28th St., N.W., Washington. Meets third Wednesday, January, March, May, and October, at 8:00 P.M., in Medical Society Library.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James T. Shelden, M.D., Box 1021, Lakeland. Meets in April and in October.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Richard D. Shapiro, M.D., 541 Lincoln Road, Miami Beach. Meets monthly, third Wednesday, 8:00 P.M.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Albert A. Rayle, Jr., M.D., 490 Peachtree St. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert M. Tankesley, M.D., 218 Doctors Bldg., Atlanta. Meets in November and at the annual meeting of the State Medical Association.

RICHMOND COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Wm. F. Hamilton, Jr., M.D., University Hospital, Augusta. Meets first Thursday of each month.

Hawaii

RADIOLOGICAL SOCIETY OF HAWAII. *Secretary*, Philip S. Arthur, M.D., Suite 42, Young Hotel Bldg., Honolulu. Meets third Friday of each month.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Elbert K. Lewis, M.D., 6337 S. Harvard Ave., Chicago 21. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Stephen L. Casper, M.D., Physicians and Surgeons Clinic, Quincy.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, George E. Irwin, Jr., M.D., 427 N. Main St., Bloomington.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, John A. Robb, M.D., 238 Hume-Mansur Bldg., Indianapolis 4. Meets twice a year, first Sunday in May and during fall meeting of State Medical Association.

TRI-STATE RADIOLOGICAL SOCIETY (Southern Indiana, Northwestern Kentucky, Southeastern Illinois). *Secretary-Treasurer*, Stephen N. Tager, M.D., 219 Walnut St., Evansville 9, Ind. Meets last Wednesday, October, January, March, and May, 8:00 P.M., at the Elks' Club, Evansville, Ind.

Iowa

IOWA RADIOLOGICAL SOCIETY. *Secretary*, James T. McMillan, M.D., 1104 Bankers Trust Bldg., Des Moines. Meets during annual session of State Medical Society, and in the Fall.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, A. M. Cherner, M.D., Hays, Kansas. Meets in the Spring with the State Medical Society and in the Winter on call.

Kentucky

KENTUCKY RADIOLOGICAL SOCIETY. *Secretary*, David Shapiro, M.D., Veterans Administration Hospital, Louisville 6. Meets monthly, second Friday, at Seelbach Hotel, Louisville.

Louisiana

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets second Tuesday of each month.

RADIOLOGICAL SOCIETY OF LOUISIANA. *Secretary-Treasurer*, J. T. Brierre, M.D., 700 Audubon Bldg., New Orleans.

SHREVEPORT RADIOLOGICAL CLUB. *Secretary*, W. R. Harwell, M.D., 608 Travis St. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Jack Spencer, M.D., Maine General Hospital, Portland 4. Meets three times a year—Spring, Summer, and Fall.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary-Treasurer*, H. Leonard Warres, M.D., 2337 Eutaw Place, Baltimore 17. Meets third Tuesday, September to May.

MARYLAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, H. Leonard Warres, M.D., 2337 Eutaw Place, Baltimore 17.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, E. F. Lang, M.D., Harper Hospital, Detroit 1. Meets first Thursday, October to May, at Wayne County Medical Society club rooms.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, John R. Hodgson, M.D., The Mayo Clinic, Rochester. Meets in Spring and Fall.

Mississippi

MISSISSIPPI RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John W. Evans, M.D., 117 N. President St., Jackson, Miss. Meets monthly, on third Tuesday, at 6:30 P.M., at the Rotisserie Restaurant, Jackson.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, James E. McConchie, M.D., First National Bank Bldg., Independence, Mo. Meets last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, Wm. B. Seaman, M.D., 510 South Kingshighway, St. Louis 10. Meets on fourth Wednesday, October to May.

Montana

MONTANA RADIOLOGICAL SOCIETY. *Secretary*, Grant P. Raitt, M.D., 413 Medical Arts Bldg., Billings. Meets annually.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James F. Kelly, Jr., M.D., 816 Medical Arts Bldg., Omaha. Meets third Wednesday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, Stanley M. Wyman, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday, at the Harvard Club, Boston.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., 127 Washington St., Keene.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary,* Salomon Silvera, M.D., 921 Bergen Ave., Jersey City. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meets second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary,* Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 2. Meets in January, May, and October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary,* Solomon Maranov, M.D., 1450 51st St., Brooklyn 19. Meets fourth Thursday, October to April (except December), at 9:00 P.M., Kings County Medical Bldg.

NASSAU RADIOLOGICAL SOCIETY. *Secretary,* Frank Huber, M.D., 131 Fulton Ave., Hempstead, N. Y. Meets second Tuesday, February, April, June, October, and December.

NEW YORK ROENTGEN SOCIETY. *Secretary,* Jacob R. Fried, M.D., 1049 Park Ave., New York.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* Donald H. Baxter, M.D., Albany Hospital, Albany. Meets in the capital area second Wednesday, October, November, March, and April. Annual meeting in May or June.

RADIOLOGICAL SOCIETY OF NEW YORK STATE. *Secretary-Treasurer,* Mario C. Gian, M.D., 610 Niagara St., Buffalo. Meets annually with the State Medical Society.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer,* Henry H. Forsyth, Jr., M.D., 40 Meigs St., Rochester 7. Meets at Strong Memorial Hospital, 8:15 P.M., last Monday of each month, September through May.

WESTCHESTER RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* Maynard G. Priestman, M.D., New Rochelle Hospital, New Rochelle, N. Y. Meets third Tuesday of January and October and at other times as announced.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary,* Waldemar C. A. Sternbergh, M.D., 1400 Scott Ave., Charlotte 2. Meets in April and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* H. Milton Berg, M.D., Quain & Ramstad Clinic, Bismarck. Meets in the Spring with State Medical Association; in Fall or Winter on call.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* M. M. Thompson, Jr., M.D., 316 Michigan St., Toledo.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* Howard W. Bangs, 1381 West Sixth Ave., Columbus 12. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* Mortimer Lubert, M.D., Heights Medical Center Bldg., Cleveland Heights 6. Meets at 6:45 P.M. on fourth Monday, October to April, inclusive.

GREATER CINCINNATI RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* Chapin Hawley, M.D., 927 Carew Tower, Cincinnati 2. Meets first Monday of each month, September to June, at Cincinnati General Hospital.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary,* W. S. Koller, M.D., 60 Wyoming St., Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* John R. Danstrom, M.D., Medical Arts Bldg., Oklahoma City.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* John Wayne Loomis, M.D., 919 Taylor Street Bldg., Portland 5. Meets monthly, second Wednesday, October to June, at 8:00 P.M., University Club, Portland.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary,* Herbert M. Stauffer, M.D., Temple University Hospital, Philadelphia 40. Meets first Thursday of each month at 5:00 P.M., from October to May, in Thompson Hall, College of Physicians.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer,* Donald H. Rice, M.D., 4800 Friendship Ave., Pittsburgh 24. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* John H. Freed, M.D., 4200 East Ninth Ave., Denver 7, Colo.

South Carolina

SOUTH CAROLINA RADIOLOGICAL SOCIETY. *Secretary-Treasurer,* William A. Klauber, M.D., Self Memorial Hospital, Greenwood. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer,* Donald J. Peik, M.D., 303 S. Minnesota Ave., Sioux Falls. Meets during annual meeting of State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. *Secretary*, Harvey Thompson, M.D., 899 Madison Ave. Meets first Monday of each month at John Gaston Hospital.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, George K. Henshall, M.D., 311 Medical Arts Bldg., Chattanooga 3. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH RADIOLOGICAL CLUB. *Secretary*, Otto H. Grunow, M.D., 650 Fifth Ave., Fort Worth 4, Texas. Meets monthly, third Monday 6:30 P.M., at the Greater Fort Worth International Airport.

HOUSTON RADIOLOGICAL SOCIETY. *Secretary*, Harry Fishbein, M.D., 324 Medical Arts Bldg., Houston 2.

SAN ANTONIO-MILITARY RADIOLOGICAL SOCIETY. *Secretary*, Hugo F. Elmendorf, Jr., M.D., 730 Medical Arts Building, San Antonio 5, Texas. Meets at Brook Army Medical Center, the first Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting Jan. 29-30, 1954, Dallas.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City 1. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., 1308 Manteo St., Norfolk 7.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Eva L. Gilbertson, M.D., 1317 Marion St., Seattle 4. Meets fourth Monday, September through May, at 610 Pine St., Seattle.

West Virginia

WEST VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, W. Paul Elkin, 515-519, Medical Arts Bldg., Charleston. Meets concurrently with annual meeting of State Medical Society, and at other times as arranged by Program Committee.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Jerome L. Marks, M.D., 161 W. Wisconsin Ave., Milwaukee 1. Meets monthly on fourth Monday at the University Club.

SECTION ON RADIOLOGY, STATE MEDICAL SOCIETY OF WISCONSIN. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee 2. Meets in October with State Medical Society.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursday at 4 P.M., September to May, Service Memorial Institute.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. W. Moir, M.D., Sheboygan Memorial Hospital, Sheboygan.

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Rafael A. Blanes, M.D., Box 9724 Santurce, Puerto Rico.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, D. L. McRae, M.D., *Assoc. Hon. Secretary-Treasurer*, Guillaume Gill, M.D., *Central Office*, 1555 Summerhill Ave., Montreal 25, Quebec. Meets in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTRO-RADIOLOGIE MÉDICALES. *General Secretary*, Ls Ivan Vallée, M.D., Hôpital Saint-Luc, 1058 rue St-Denis, Montreal 18. Meets third Saturday of each month.

L'ASSOCIATION DES RADIOLOGISTES DE LA PROVINCE DE QUEBEC. *ASSOCIATION OF RADIOLOGISTS OF THE PROVINCE OF QUEBEC.* *Secretary*, Jean-Pierre Jean, M.D., 4039 Tupper St., Westmount, Que. Meets four times a year.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPIA DE CUBA. *Secretary*, Dr. Rafael Gómez Zaldívar. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA, A. C. *Headquarters*, Calle del Oro, Num. 15, Mexico 7, D. F. *Secretary General*, Dr. Eugenio Toussaint. Meets first Monday of each month.

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor*, Luis Arrieta Sánchez, M.D., Apartado No. 86, Panama, R de P.

ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

- FALK, BENGT. Encephalography in Cases of Intracranial Tumours..... 888
- ZIEDES DES PLANTES, B. G. Ventriculography with Small Amounts of Air..... 888
- CHILDE, ARTHUR E., ET AL. Ventriculographic Examination of the Aqueduct of Sylvius and Fourth Ventricle. Five Unusual Cases..... 888
- ANDERSSON, TURE. Pneumographic Diagnosis of Meningeomata of the Falx..... 888
- OLSSON, OLLE. Vertebral Angiography..... 888
- SJÖGREN, S. E. Percutaneous Vertebral Angiography. A Review of 250 Cases..... 889
- DECKER, K. Displacement of the Posterior Cerebral Artery in Vertebral Angiograms..... 889
- HOARE, R. D. Arteriovenous Aneurysm of the Posterior Fossa..... 889
- RICHTER, HS. R. Collaterals Between the External Carotid Artery and the Vertebral Artery in Cases of Thrombosis of the Internal Carotid Artery..... 889
- LÖFGREN, F. OLOV. Carotid Angiography in the Diagnosis of Spontaneous Intracerebral Haemorrhage..... 890
- GVOZDANOVIĆ, V., AND RIESSNER, D. Angiographic Studies in the Problem of Brain Revascularization..... 890
- JOHANSON, CURT. The Cerebral Phlebogram by Carotid Angiography in Cases of Central Brain Tumours..... 890
- RICHTER, HS. R. Phlebography in Brainstem Tumours..... 890
- FISCHGOLD, H., ET AL. Direct Opacifying Injections into the Venous System of the Head..... 890
- MASY, S., AND GRÉGOIRE, A. Cisternography..... 890
- BOURDON, R. Cranial Tomography in Neuro-radiology. Tomography of the Base of the Skull..... 891
- SJÖGREN, S. E. Experiences in Localisation of Brain Tumors by Means of Diiodo¹³¹ Fluorescein..... 891
- MCRÆ, D. L. Bony Abnormalities in the Region of the Foramen Magnum: Correlation of the Anatomic and Neurologic Findings..... 892
- ANDERSEN, POUL E. Radiological Diagnosis of Lipoma of the Corpus Callosum..... 892
- SUTTON, DAVID. Radiologic Aspects of Pontine Gliomata..... 892
- WICKBOM, INGMAR, AND SHELDON, PHILIP. Some Aspects of the Radiologic Diagnosis of Posterior Fossa and Supra-Sellar Tumours..... 893
- GARCIA, P. J., AND LAXAMANA, A. M. A Report on the Radiographic Measurements of the Normal Sella Turcica in Filipinos..... 893
- SJÖGREN, S. E., AND FREDZELL, GEORG. Apparatus for Serial Angiography..... 893

The Chest

- ZOLLINGER, H. U., AND FISCHER, F. K. Further Empirical and Experimental Studies with Joduron Bronchography..... 893
- CUMMINS, CHRISTOPHER, AND SILVER, C. P. Bronchography with a Rapidly Eliminated Compound "Dionosil"..... 894
- WEBER, H. W., AND LÖHR, B. Clinical Findings and Anatomical Changes in the Lungs Following Bronchography with Perabrodil BR (Viscosity 60 per cent)..... 894
- PARK, FELIX R., ET AL. Prevention of Iodism in Bronchography by Use of ACTH. Case Report..... 894
- BÖHM, F. Problem of Surface Anesthesia of the Upper Air Passages..... 894
- LIESE, E., ET AL. Contribution to the Early Diagnosis of Bronchial Carcinoma by Simple Contrast Demonstration of the Bronchial Tree..... 895
- GOMBERT, H. J., ET AL. Roentgenologic and Clinical Aspects of Lung Resection (Operability and the Postoperative Course)..... 895
- ROTKÓCZY, NÁNDOR. Cancer of the Lungs with Metastases in the Lungs..... 895
- YERUSHALMY, J. The Reliability of Chest Roentgenography and Its Clinical Implications..... 896
- HEDVALL, ERIK. "Initial Foci," a Special Group of Minimal Tuberculosis..... 896
- ADLER, HUGO. Phthisiogenetic Considerations Based on Tomographic Analysis of 320 Consecutive Cases of Localized Pulmonary Tuberculosis in Adults..... 896
- BOYD, GLADYS. Intralobar Pulmonary Sequestration..... 896
- SOUCHERAY, PHILIP H., AND O'LOUGHLIN, BERNARD J. Cavitation within Bland Pulmonary Infarcts..... 897
- PEABODY, J. WINTHROP, JR., ET AL. Intrathoracic Hibernoma..... 897
- MÜLLER, H. Cyst Formation in Graphite Pneumoconiosis..... 897
- MARTIN, E., AND FALLET, G. H. Chronic Pneumopathies and Rheumatism..... 897
- WERNER, K. Contribution to Besnier-Boeck-Schaumann Disease..... 897
- LUDWIG, H., AND GORIDIS, D. D. Calculation of the Size of the Heart by Means of the Transverse Diameter Sum..... 898
- MARKS, PAUL A., AND ROOF, BETTY S. Pericardial Effusion Associated with Myxedema..... 898
- KURLAND, GEORGE S., ET AL. The Heart in I¹³¹. Induced Myxedema. Comparison of the Roentgenographic and Electrocardiographic Findings Before and After the Induction of Myxedema..... 898

- BENCHIMOL, AARON B., AND SCHLESINGER, PAUL. Beriberi Heart Disease..... 899
- ROWE, RICHARD D., AND VLAD, PETER. Persistent Truncus Arteriosus. Two Cases with Right Aortic Arch..... 899
- The Digestive System**
- WARTHIN, THOMAS A., ET AL. The Management of Upper Gastrointestinal Hemorrhage..... 899
- WERBELOFF, L., AND MERSKEY, C. Gastroesophageal Regurgitation: Its Incidence and Relation to Symptoms..... 900
- NISSEN, R. Difficulties in the Early Diagnosis of Carcinoma of the Esophagus..... 900
- COCCHI, UMBERTO. Roentgen Diagnosis of Peptic Ulcer of the Esophagus..... 900
- STÖSSEL, H. U. Clinical Significance of Pharmacoradiography, Particularly of Morphine, in Diseases of the Stomach and Duodenum..... 901
- ZUPPINGER, A., AND LÄSER, S. Roentgen Examination of the Stomach with Special Consideration of the Diagnosis of Cancer..... 901
- GRASSER, C. H. Roentgen Studies of Two Cases of Primary Retothel Sarcoma of the Stomach. 901
- LUST, FRANZ J. Correlation of Roentgenological Studies with Certain Clinical Symptoms in Peptic Ulcer..... 902
- SIMON, GEORGE, AND DU BOULAY, GEORGE. The Value of Radiology in Assessing the Progress of Duodenal Ulceration Under Treatment.... 902
- FEINBLATT, THEODORE M., AND FERGUSON, EDGAR A., JR. CCK Treatment for the Syndrome of Vague Abdominal Distress..... 903
- ZDANSKY, E., ET AL. Tannin Enema in Inflammatory Conditions of the Colon..... 903
- SAWYERS, THOMAS M., AND ROSENFELD, DAVID D. Appendiceal Stones Simulating Ureteral Calculi..... 903
- FROMMHOLD, W. A New Contrast Medium for Cholecystography..... 903
- HORNKYIEWYTSCH, TH., AND STENDER, H. St. Intravenous Cholangiography..... 904
- HUBER, K., AND STÖSSEL, H. U. Intravenous Cholangiography with Biligrafin..... 905
- SEEDORF, E. E., ET AL. Telepaque and Pseudoalbuminuria..... 905
- The Musculoskeletal System**
- HART, F. DUDLEY. Ankylosing Spondylitis..... 905
- OTT, V. R. Spondylosis Hyperostotica..... 905
- LISS, G. Peculiar Structural Changes in the Epiphyseal and Metaphyseal Regions in Osteogenesis Imperfecta Tarda..... 906
- BEUTEL, A. Serial Radiographic Observations During the Early Stage of Acquired Syphilis with Follow-up X-ray Films..... 906
- SCHLUMBERGER, HANS G., AND BURK, DONALD H. Comparative Study of the Reaction to Injury. II. Hypervitaminosis D in the Frog with Special Reference to the Lime Sacs..... 906
- DAVIES, JOHN J., AND PEIRCE, E. CONVERSE, II. Discography in the Diagnosis of Herniation of the Lower Lumbar Intervertebral Discs..... 907
- BUETTI, C. Aseptic Necrosis of the Capitulum Humeri..... 907
- RÖSLI, A. Occurrence of Bipartite Os Radiale Dorsale. Previously Unreported Accessory Bones of the Radiocarpal Joint..... 907
- Gynecology and Obstetrics**
- ADAMS, THEODORE W., ET AL. Intrauterine Roentgenography as an Aid in Determining Fetal Age..... 907
- MOIR, J. CHASSAR. Placentography. Symposium. I. Opening Address, A Review of Placentography..... 908
- GROSSMAN, MARIA E. II. Direct Placentography..... 908
- NORMAN, OLOF. III. Localisation of the Placenta by Means of Arteriography and Auscultation..... 908
- WHITEHEAD, A. S. IV. Diagnosis of Placenta Praevia by Soft Tissue Radiography..... 908
- REID, F. V. Radiological Localisation of the Placenta..... 908
- The Genitourinary System**
- NESBIT, REED M., AND NESBITT, THOMAS E. Experiences with High Concentration Urokon for Pyelography..... 908
- BYRNE, JOHN E., AND MELICK, WILLIAM F. Clinical Experiences with a New Medium (70 Per Cent Urokon-Sodium) in Intravenous Urography..... 909
- SEYSS, R. Functional Roentgenology of the Urinary Tract..... 909
- HARVARD, MARVIN. Renal Angiography..... 910
- SMITH, PARKE G. A Résumé of the Experience in the Making of 1,500 Renal Angiograms.... 910
- HINMAN, FRANK, JR. A Simple Injector for Aortography and Intravenous Angiography.. 910
- HAMM, FRANK C., AND HARLIN, HARRISON C. Perirenal Insufflation with Arteriography.... 910
- LERMAN, FRED, ET AL. Presacral Oxygen Injection..... 910
- BURNS, EDGAR. Clinical Diagnosis of Tumors of Adult Renal Parenchyma..... 911
- BERMAN, MICHAEL H., AND COPELAND, HERBERT. Filling Defects of Ureterogram Caused by a Varicose Ureteral Vein..... 911
- BRUNKOW, C. D. Evaluation of Size of Bladder Neoplasms..... 911
- NAGLE, ROBERT B., AND PEIRSON, EDWARD L. A Study of the Radiation Hazard in Urology. 911
- The Spinal Cord**
- ODÉN, SVEN. Diagnosis of Spinal Tumours by Means of Gas Myelography..... 911
- BULL, J. W. D. Spinal Meningiomas and Neurofibromas..... 912

RADIOTHERAPY

- BUSCHKE, F. Fourteen Years of Supervoltage Therapy in the Swedish Hospital, Seattle, U.S.A. 913
- LINDGREN, MARTIN. Roentgen Treatment of Gliomata..... 913
- PERUSSIA, FELICE. Radiation Therapy of Carcinoma of the Palate..... 914
- LEWIS, CHARLES L. Treatment of the Meningeal System by Means of Radioactive Colloidal Gold and X-Rays..... 914
- CULP, D. A. Testicular Neoplasms: An Analysis of 113 Cases..... 914
- LIVERMORE, GEO. R. Wilms's Tumor in an Adult: Report of a Ten Year Cure..... 914
- MÜLLER, J. H. Case of Giant Follicular Lymphoblastoma (Brill-Symmers Disease) of the Pelvic Lymph Nodes Clinically Resembling an Ovarian Tumor, with Five-Year Freedom from Symptoms Following Radiation Therapy..... 915
- V. BRAUNBEHRENS, HANS. Radiation Therapy of Paget's Disease of the Breast..... 915
- ACETO, JOSEPH N., ET AL. X-ray Therapy of Peripheral Tuberculous Lymphadenitis..... 915

RADIOISOTOPES

- BARRY, MICHAEL C., AND PUGH, ALBERT E. Serum Concentrations of Radioiodine in Diagnostic Tracer Studies..... 916
- BARRETT, T. F., ET AL. Evaluation of a Thyroid Panel. Practical Application of Scintillation Counter in Diagnosis of Diseases of the Thyroid..... 916
- KOHL, DOUGLAS A. A Multiple-Counter System for Isotope Encephalometry..... 916
- CHAMBERLAIN, A. C., AND CHADWICK, R. C. Deposition of Airborne Radioiodine Vapor... 916
- WILKINSON, G. W., AND LEBLOND, C. P. Deposition of Radiophosphorus in Fractured Bones in Rats..... 917
- BERLIN, NATHANIEL I., ET AL. Blood Volume in Pregnancy as Determined by P³² Labeled Red Blood Cells..... 917

- WUHRMANN, F., AND JASIŃSKI, B. Investigations to Determine the Union of Iron with Beta Globulin and Its Clinical Significance with the Aid of Fe⁵⁹..... 917
- DAVISON, SOL., ET AL. Dosimetry of a Kilocurie Cobalt-60 Source..... 918
- GETZOFF, PAUL, ET AL. A Syringe Shield Used in Injecting Radioactive Gold..... 918
- TOCHILIN, E., AND GOLDEN, R. Film Measurement of Beta-Ray Depth Dose..... 918
- WEST, R. Isotope Handling Calculator..... 918
- HURST, W. M. Monitoring of Liquids for Radioactivity..... 918
- OBRZYCKI, R. F., ET AL. Economical Shielding for Multicurie Sources..... 919
- HANSARD, SAM L., AND COMAR, C. L. Radioisotope Procedures with Laboratory Animals. 919

RADIATION EFFECTS

- LUSHBAUGH, C. C., ET AL. Experimental Acute Radiodermatitis Following Beta Irradiation. I. Its Pathogenesis, and Repair. II. The Inhibition of Fibroplasia. III. The Changes in Water, Fat, and Protein Content. IV. Changes in Respiration and Glycolysis. V. Histopathological Study of the Mode of Action of Therapy with Aloe vera..... 919
- TURNER, FRANCES M. An Investigation into the Relationship between Physiologically Low Leucocyte Counts and Sickness Absence..... 920
- SKOW, R. K., ET AL. Hazard Evaluation and Control After a Spill of 40 Mg. of Radium... 921
- GUNZ, F. W. Bone Marrow Changes in Patients with Chronic Leukemia Treated by Splenic X-irradiation..... 921
- GREULICH, WILLIAM W., ET AL. The Physical Growth and Development of Children Who Survived the Atomic Bombing of Hiroshima or Nagasaki..... 921
- HARLEY, JOHN H. Sampling and Measurement of Airborne Daughter Products of Radon..... 922
- RUGH, ROBERTS, ET AL. Shock, Toxemia in Radiation Lethality..... 922



ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Encephalography in Cases of Intracranial Tumour. Bengt Falk. *Acta radiol.* 40: 220-233, August-September 1953.

In order to justify his preference for encephalography over ventriculography in the diagnosis of intracranial tumors, the author reports on 1,841 encephalographies and describes the proper method of performing the examination and the precautions to be taken to avoid complications. The technic used has been described by Lindgren (*Acta radiol.* 31: 161, 1949. *Abst. in Radiology* 54: 130, 1950). There was good air filling of the ventricles in 95 per cent of all cases. Twenty-four of 195 tumor cases showed no air in the ventricles. Nevertheless the existence of a tumor was demonstrated in all but 3 of these patients and it was exactly localized in 7.

Encephalography actually is superior to ventriculography in that extracerebral expanding lesions, especially those situated basally, may in many instances be identified as to type as well as location. One can differentiate suprasellar extracerebral, suprasellar intracerebral, and intrasellar tumors by their outlines due to cisternal air. The extracerebral fluid spaces in the posterior fossa, the fourth ventricle, and the aqueduct are more easily visualized than by ventriculography and obstructing central tumors are more readily outlined.

Six patients had herniation attacks following the examination. All recovered except one, who died following a subsequent ventriculography. The excellent diagnostic results far outweigh the risks.

Twenty-five roentgenograms.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

Ventriculography with Small Amounts of Air. B. G. Ziedses des Plantes. *Acta radiol.* 40: 261-266, August-September 1953.

Following injection of 10 c.c. of air into the lateral ventricles the patient is made to turn a backward somersault to insure filling of the posterior part of the third ventricle, and the fourth ventricle. The basal cisterns and the brain surface are demonstrated following a forward somersault. The forward somersault is also used to fill both inferior horns simultaneously, with a small amount of air. Minute deformities can be detected easily in this way.

The shift of the air during the somersaults is shown diagrammatically by line drawings.

Five roentgenograms.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

Ventriculographic Examination of the Aqueduct of Sylvius and Fourth Ventricle. A Report of Five Unusual Cases. Arthur E. Childe, Dwight Parkinson, and Jan Hoogstraten. *Acta radiol.* 40: 211-219, August-September 1953.

Precise localization of lesions which deform, displace, or obstruct the aqueduct of Sylvius and the fourth ventricle should usually be possible provided sufficient gas is introduced into the ventricular system. The authors perform ventriculography with relatively large amounts of oxygen and follow it immediately by surgery, if this is indicated.

If the initial "brow-up" films show dilated lateral and a dilated mid-line third ventricle, then the patient is placed in the prone position and the head is turned rapidly to trap the gas in the posterior part of the third ventricle. The head is then lowered over the table and is shaken to allow the oxygen to pass as far caudally as possible. Three posterior-anterior roentgenograms are then made, each with a stereoscopic shift of the tube, thus providing two sets of stereoscopic films. Lateral "brow-down" and ordinary stereoscopic right and left lateral views complete the examination of the aqueduct of Sylvius and the fourth ventricle.

Five selected cases investigated by this method and proved by surgery are described. They are: tuberous sclerosis of the aqueduct; diverticulum of the lateral ventricle and cerebellar cyst; astrocytoma of the fourth ventricle; cerebellar hematoma; colloid cysts of the fourth ventricle.

Five roentgenograms.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

Pneumographic Diagnosis of Meningeomata of the Falx. Ture Andersson. *Acta radiol.* 40: 195-210, August-September 1953.

This paper is based upon observations of 51 meningiomas of which 36 were localized to the falx without involving the superior longitudinal sinus or extending laterally. Meningiomas confined to the falx are differentiated pneumographically from parasagittal meningiomas by the observation of greater medial than lateral depression of the roof of the lateral ventricle. This phenomenon was not observed in tumors extending to the superior longitudinal sinus or lateral to it. Other ventricular deformities depend on the specific location of the tumor in the falx. If subdural air is demonstrated above the tumor, then the tumor cannot be attached to the dura lateral to the sinus.

Falx meningiomas must also be differentiated from gliomas of the corpus callosum. Gliomas grow into the ventricles irregularly and force them apart by invasion of the septum lucidum. Meningiomas never invade and always impress the lateral ventricles evenly. Gliomas are excluded if air fills the cisterna corporis callosi below the tumor.

Twenty-four roentgenograms; schematic drawings.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

Vertebral Angiography. Olle Olsson. *Acta radiol.* 40: 103-107, August-September 1953.

The author reviews 240 vertebral arteriographic studies performed by means of radial catheterization (see Radner, S.: *Acta radiol.*, Suppl. 87, 1951. *Abst. in Radiology* 58: 128, 1952). An ordinary ureteral catheter is inserted into the radial artery in the forearm and is manipulated into the vertebral artery. The method has been found to be very satisfactory, being completely unsuccessful in only 2 of these cases. Arterial spasm is the chief complication.

The method was found helpful in the search for aneurysms, for supratentorial tumors in the posterior part of the brain, and certain infratentorial tumors. As yet, however, it has proved disappointing in the detection of characteristic vascular changes in the medulloblasto-

mas. Nor has establishment of tumor diagnosis by vascular displacement been as easily obtained as is the case with the carotid system. The vertebral system does not bear as regular a relationship to the mid-line, and there is more variability from side to side and from one patient to another. Any difference in the vascular pattern of the two sides may be explained not only by normal variations but by differences in the distribution of the flow of contrast medium at the bifurcation of the basilar artery.

The percentage of tumors that can be defined with certainty by vertebral angiography without subsequent pneumography is still too small. Time and further experience may increase the diagnostic accuracy of this method.

THEODORE E. KEATS, M.D.
University of California

Percutaneous Vertebral Angiography. A Review of 250 Cases. S. E. Sjögren. *Acta radiol.* 40: 113-127, August-September 1953.

For percutaneous vertebral angiography as described here, the examiner presses two fingers between the vessels of the neck and the trachea, which is pushed over to the normal side. The needle is then introduced through the skin near the mid-line and directed toward an intervertebral space 1 to 2 cm. higher up, the direction of the puncture being oblique—backward, upward, and laterally. The results in 150 cases seem to be comparable to those obtained by the catheter method, with the added advantages of lesser complexity and ease of bilateral injection.

A short review is given of a total material of over 150 cases. In 2 cases the procedure could not be carried out, and in 10 satisfactory filling of the intracranial branches of the vertebral artery was not obtained. Special attention is directed to the possibility of localizing even poorly vascularized expanding lesions in the posterior fossa and the importance of the posterior inferior cerebellar artery for this purpose. Expanding processes in the posterior fossa usually cause herniation of part of its contents, upward through the tentorial notch or downward through the foramen magnum, or both. Either herniation may cause displacement of adjacent vessels and angiographic demonstration is thus possible. In herniation through the foramen magnum, the posterior inferior cerebellar artery follows the cerebellar tonsils downward and is more or less deformed.

With the exception of these changes due to herniation, the vascular displacements are similar to those above the tentorium. The significant changes involve the small vessels predominantly. Displacement of the basilar artery has localizing significance mainly in extracerebral tumors, as meningiomas and chordomas.

Knowledge of the numerous anatomic variations of the vertebral system is still incomplete, and reliability of the method is not as high as that of encephalography, but out of the 38 cases of verified infratentorial tumors, all but one could be recognized, and the majority localized, by vertebral angiography.

Seventeen roentgenograms; 2 photographs.

THEODORE E. KEATS, M.D.
University of California

The Displacement of the Posterior Cerebral Artery in Vertebral Angiograms. K. Decker. *Acta radiol.* 40: 91-95, August-September 1953.

The author discusses vascular displacements associated with tumors in the posterior cranial fossa, with

particular reference to variations in the course of the posterior cerebral artery as seen in vertebral angiograms.

A great similarity was found in the course of the posterior cerebral artery in normal subjects, and positions of this artery in cases of cerebral tumor also had much in common. It was noted that upward displacement of the posterior cerebral artery begins in its middle third and that only in the presence of large tumors does this displacement also occur at the bifurcation of the basilar artery. Vascular displacement is considered as important for the angiographic diagnosis of infratentorial expanding lesions as the pressure of the basilar artery against the clivus. In one-half of the author's cases of cerebellar tumor, the vessels were distinctly displaced upward. In no normal cases were similar displacements noted.

In a series of 150 vertebral arteriographies, only 3 instances of typical tumor vascularization were found. In an additional 20 per cent, the vascular displacement described was so distinct that it permitted a diagnosis.

Four roentgenograms; 1 drawing.

THEODORE E. KEATS, M.D.
University of California

Arteriovenous Aneurysm of the Posterior Fossa. R. D. Hoare. *Acta radiol.* 40: 96-102, August-September 1953.

Three cases of posterior fossa arteriovenous aneurysm demonstrated by vertebral arteriography are reported. Each showed on plain roentgenograms signs of hypertrophy of the vertebral arteries manifested by changes in the bones forming the canal through which these arteries pass. This is similar to the enlargement of the carotid canal in cases of large supratentorial arteriovenous aneurysm. With an arteriovenous aneurysm of the posterior fossa, the groove or foramen in the posterior arch of the atlas and the foramen transversarium of the axis are enlarged. A very large jugular foramen may further support the diagnosis. Increased vascularization of the skull vault in the posterior half may also suggest an infratentorial vascular lesion.

Ten roentgenograms. THEODORE E. KEATS, M.D.
University of California

Collaterals Between the External Carotid Artery and the Vertebral Artery in Cases of Thrombosis of the Internal Carotid Artery. Hs. R. Richter. *Acta radiol.* 40: 108-112, August-September 1953.

The author describes a route of collateral blood flow between the external carotid artery and the vertebral artery. By vertebral angiography he was able to demonstrate branches to the neck muscles from the vertebral artery in 25 out of 30 cases. In 2 cases of thrombosis of the internal carotid artery, reported here, a network of vessels in the muscles of the neck formed a collateral path between the occipital branch of the external carotid artery and the vertebral arteries. The basilar and posterior cerebral arteries were visualized by this route.

An additional important collateral system in thrombosis of the internal carotid artery has been described by Marx, the blood passing from the facial branch of the external carotid artery via the angular and ophthalmic arteries to the carotid siphon (*Acta radiol.* 31: 155, 1949. *Abst. in Radiology* 54: 138, 1950).

Two roentgenograms; 1 drawing.

THEODORE E. KEATS, M.D.
University of California

Carotid Angiography in the Diagnosis of Spontaneous Intracerebral Haemorrhage. F. Olov Löfgren. *Acta radiol.* 40: 173-181, August-September 1953.

Fifty-four cases of spontaneous intracerebral bleeding were subjected to percutaneous carotid angiography with "Umbradil" 35 per cent. Most of the patients were examined in the acute stage, with only two minor complications. Cases were divided into five groups, as follows: (1) cases with an expansive process in the subcortical white matter; (2) cases with signs of an expansive process in the deeper structures; (3) cases in which the vascular pattern was normal, but there was an area of cerebral softening or small hemorrhage; (4) thrombosis of an artery; (5) aneurysms. Only Groups 1 and 5, the author states, are accessible to surgery.

The separation of the cases into the above groups was made possible by carotid angiography, and thus the choice of treatment, whether conservative or surgical, was greatly facilitated.

Eighteen roentgenograms; 2 photographs; 1 table.
EMORY G. WEST, M.D.
Palo Alto Clinic

Angiographic Studies in the Problem of Brain Revascularization. V. Gvozdanović and D. Riessner. *Acta radiol.* 40: 139-154, August-September 1953.

Angiographic studies were used by the authors for the evaluation of the operation for revascularization of the brain described by Beck and his co-workers (production of a fistula between the right common carotid artery and the right internal jugular vein).

The operation was performed in 15 children between two and twelve years of age with mental retardation and epileptic fits due to birth trauma or encephalomeningitis. Serial angiography was done both before and after the production of the fistula, with retrograde phlebography to determine the suitability for operation.

It was shown that after the Beck procedure, the arterial blood enters neither the cortex nor the deep veins of the brain, but passes, *via* the transverse sinus of the opposite side and the emissaries, sinuses, and plexuses of the same side, into the veins of the occiput, neck, pharynx, and spine. Because the arterial blood is shunted over to the descending veins of the neck, the arterial flow to the brain is reduced and the right side of the heart may be overburdened.

On the basis of the cases studied, it is concluded that no clinical improvement can be expected after the production of Beck's fistula.

Twenty-three roentgenograms.

EMORY G. WEST, M.D.
Palo Alto Clinic

The Cerebral Phlebogram by Carotid Angiography in Cases of Central Brain Tumours. Curt Johanson. *Acta radiol.* 40: 155-172, August-September 1953.

Thirty cadavers were used in the study of the normal anatomy and variations of the deep cerebral veins and sinuses. Roentgen examination was done following injection of a mixture of barium sulfate in water and gelatin directly into the straight sinus through a catheter. The findings were checked by dissection and were compared to 200 normal angiograms. With accurate identification of the central veins, it is possible to determine displacement from the normal location. Examples of displacement of the veins by tumors of the basal ganglia, corpus callosum, and pineal body are shown.

Central tumors were observed to influence the position of the deep veins in cases in which the arteries were undisturbed.

Nineteen figures, including 23 roentgenograms.

EMORY G. WEST, M.D.
Palo Alto Clinic

Phlebography in Brainstem Tumours. Hs. R. Richter. *Acta radiol.* 40: 182-187, August-September 1953.

The topographic relations of the arteries and veins in cerebral angiograms, and especially the relationships to the ventricular system, are discussed and illustrated.

The striothalamic vein forms, with the internal cerebral vein, a sharp angle in the region of the foramen of Monro, known as the venous angle. Displacement syndromes, including lifting, opening, and depression of the angle, occipital displacement, and displacement to the opposite side, are described and diagrammed.

It is stressed that the phlebograms have been particularly helpful in localizing deep central tumors without pathologic vascularization.

Two roentgenograms; 3 diagrammatic drawings.

EMORY G. WEST, M.D.
Palo Alto Clinic

Direct Opacifying Injections into the Venous System of the Head. H. Fischgold, M. David, J. Talairach, and P. Bregeat. *Acta radiol.* 40: 128-138, August-September 1953.

The authors point out certain advantages of direct opacifying injections into the intracranial veins and sinuses over the indirect methods of carotid or vertebral angiography. It is stated that for visualization of the diploic veins, veins of the scalp, pterygoid plexus, occipital plexus, and tributaries of the external and posterior jugular veins, the indirect method is not satisfactory. Direct injection of the contrast medium is possible in the case of the superior sagittal sinus, the ophthalmic vein, and the diploic veins.

The following procedures are described (with excellent illustrations): (1) direct sinusography without high pressure; (2) direct sinusography against the blood stream with high pressure; (3) opacification of the falx cerebri and tentorium, by direct injection into the superior sagittal sinus at the level of the coronal suture; (4) contrast filling of the cavernous sinus, by direct injection of the ophthalmic vein through an orbital incision; (5) diploegraphy (injection with or without high pressure through a trocar inserted into the skull).

Direct sinusography against the blood stream with high pressure has served to demonstrate collaterals between the circulation of the brain and facial venous system. Opacification of the falx cerebri and tentorium has resulted in complications and one fatal accident, and is not recommended. Diploegraphy makes possible the visualization of the posterior and external jugular and vertebral veins, as well as the anastomoses between the venous circulation of the brain, the meninges, the great sinuses, the vault, and the arachnoidian plexuses.

Fourteen roentgenograms.

EMORY G. WEST, M.D.
Palo Alto Clinic

Cisternography. S. Masy and A. Grégoire. *J. belge de radiol.* 36: 416-443, 1953.

A definition and the history of cisternography are given, and the morphologic and anatomical aspects are

reviewed. Methods of injecting the air as well as the radiographic technic are discussed. With the head in various stages of flexion and hyperextension, the air may be encouraged to outline the posterior and anteriorly placed basal cisterns. Lack of visualization may be noted in some cases of basal meningitis, but occasionally this finding is of doubtful significance. A tumor may sometimes be seen, outlined by gaseous contrast in one of the basal cisterns. One must be especially careful about drawing unjustified conclusions when there is lack of filling or when some spurious type of picture is obtained.

Twenty-four roentgenograms; 13 drawings.

CHARLES M. NICE, M.D.
University of Minnesota

Cranial Tomography in Neuroradiology, Tomography of the Base of the Skull. R. Bourdon on behalf of Drs. Bourdon, Fischgold, Mme Gilles, Drs. Herdner, Lenzi, Lombardi, Mascherpa, Oliva, Piazza, Porcher, and Vallebona. *Acta radiol.* 40: 272-279, August-September 1953.

The author describes the application and discusses the usefulness of tomography for the more precise and adequate diagnosis of various lesions or anatomical malformations of the base of the skull. The patient should be immobilized, the tube and film being moved at an angle of 50 to 60 degrees; the optimum thickness of the cut should be 5 mm., with a focus distance of 1 meter and a longitudinal or sinusoidal type of anode displacement. Different techniques are required for different locations.

The Orbit: Tomography has proved useful in unilateral exophthalmos produced by optical, olfactory, or lesser sphenoid wing meningiomas, ethmoido-frontal mucocele, and carotid aneurysms. By this means weak parts in the orbital wall (a collapse of the internal orbital wall, os planum sign) may be discovered, reactions of the ethmoid and nasal sinuses can be seen, and changes in the size of the orbit and alterations of adjoining structures can be observed. To visualize the inferior orbital fissure the submental vertical view is used; for the lacrimal groove a frontal projection is applied.

Olfactory Fossa: For the area of the olfactory fossa, tomography can be used in conjunction with encephalography. Three anatomical levels in the anterior cranial fossa—the orbital, the fronto-ethmoidal, and that of the cribriform plates—should be clearly demonstrated in order to reveal an olfactory meningioma. Tomograms in the frontal or sagittal planes should show the olfactory fossa, the nasal fossa, and crista galli. Calcifications, hyperostoses, or erosions of the anterior clinoid processes may be better seen on tomograms than on routine films. In the speno-orbital area changes in the optic foramen and superior orbital fissure may be encountered secondary to a tumor causing abnormalities of the eye and orbit.

The Sella Region: Increased intracranial pressure has little effect on the anterior clinoid processes, resembling distant pressure by hypophyseal tumors. Tomograms may aid in the discovery of local pressure. Clinoid symmetry and inter-clinoid distance (shown in 40 normal cases to be 24 to 28 mm.) must be estimated in every pathologic condition in this region. In addition to sagittal tomograms, it was found that frontal tomograms were also of great help; films were taken in an occipito-frontal position with a distance of 5 mm. between cuts. The medial section, 6 to 7 cm. from the

fronto-nasal plane, is the most useful and affords information as regards the floor of the sella, the sphenoid sinus, and temporo-sphenoidal fossa. The height of the floor of the sella, the inter-clinoid distance, and the continuity of levels between the superior margin of the petrous pyramid and superior margin of the floor of the sella should be ascertained.

Temporo-Sphenoidal Fossa: Various foramina are located in this region and tomography is helpful in evaluation of anatomic changes in cases of cerebral hypo- or hyper-pressure.

The Petrous Bone: The anatomic complexity and uneven density of the petrous bone poses various problems. At the Quinze-Vingt Hospital (Paris), examinations are done by means of 3-mm. sections and it is believed that this method might be useful when definite indications are obtained from routine films.

The Posterior Fossa: Frontal and sagittal tomography in selected planes is of aid in disclosing the presence of anatomical variations and deformities of the posterior fossa. Axial transverse tomography, in addition to the sagittal and frontal projections, has been helpful in showing (1) the occipito-atlantal joint, (2) the occipito-axoid joint, and (3) the atlanto-odontoid joint. Changes may be demonstrated at the base of the skull and lateral aspect of the occiput, as in platybasia, atlanto-axoid fusion or dislocation, basilar impression in its congenital form or secondary to osteomalacia, Paget's disease, tumor, infection, or trauma. Encephalography in conjunction with tomography is helpful in discovering tumors of the hypophyseal fossa, peri-hypophyseal area, temporal lobe, and chiasmatic region.

The following conclusions are reached

"Tomography must be protected from the double danger of asking too much or too little from it.

"This method of investigation can be efficient only after a full examination by standard methods, combined with an efficient clinical examination.

"There are special indications for tomography, for instance, in the examination of the sella turcica, where it produces more and different information than the ordinary films. In many cases this examination is easier than oblique views.

"The problem of elucidating and evaluating the symmetry of the deeply placed formations at the base of the skull may more easily be solved by tomography.

"Tomography may also prove of value in the investigation not only of local deformations, but also of distant effects in association with angiography, ventriculography and encephalography."

The author felt that tomographic films lose many essential details when reproduced and therefore did not include any illustrations in his paper.

JULIAN O. SALIK, M.D.
Baltimore, Md.

Experiences in Localisation of Brain Tumours by Means of Diiodo¹³¹ Fluorescein. S. E. Sjögren. *Acta radiol.* 40: 356-360, August-September 1953.

Radioactive diiodofluorescein was utilized in an attempt to diagnose intracranial lesions. A series of 30 cases, all in adults, was studied. The majority of the patients had brain tumors but some other types of intracranial disease, as well as some normal cases, were represented. A differential count between the two sides of the head of 10 or even 15 per cent, obtained with a Geiger counter, did not have any definite pathologic significance. It was possible to localize roughly

those tumors that were highly vascularized, especially the meningiomas. On the other hand, it was not possible, as a rule, to localize poorly vascularized processes, and on one occasion the examination indicated a tumor in a position symmetrically opposite that of the actual lesion. In the cases studied, no additional information was obtained from the test.

A dose of 1.5 mc. of diiodo¹³¹ fluorescein was injected intravenously, and the measuring of the counting rate was begun thirty to forty-five minutes after the injection was completed. Two Geiger tubes were placed at symmetrical positions on both sides of the mid-line of the skull. The correct placing of the tubes not infrequently is complicated and time-consuming.

Four illustrations. HOWARD L. STEINBACH, M.D.
University of California

Bony Abnormalities in the Region of the Foramen Magnum: Correlation of the Anatomic and Neurologic Findings. D. L. McRae. *Acta radiol.* 40: 335-354, August-September 1953.

Twenty-eight cases of occipitalization of the atlas, 21 cases of pure platybasia and basilar invagination, 11 cases of separate odontoid process of the axis, and 6 cases of chronic atlanto-axial dislocation are analyzed. One-third to one-half of the patients in each group were asymptomatic. The remainder had variable symptoms and signs which suggested multiple sclerosis, syringomyelia and syringobulbia, or brain tumor.

The essential point in the diagnosis of *occipitalization of the atlas* is some degree of bony union between the skull and the atlas. The parts of the atlas that must be clearly visualized are the anterior and posterior arches, the superior facets, and the transverse processes. Any or all of these may be fused with the skull. One lateral half of the atlas may be completely assimilated and the other half not.

The most significant findings in the author's cases were related to the odontoid process of the axis. If the odontoid was excessively long or unusually high in position, or if it was angulated posteriorly, symptoms and signs were usually found. Neurologic symptoms apparently attributable to occipitalization of the atlas were present in 19 cases.

Platybasia means flattening of the base of the skull, that is, a basal angle that approaches 180 degrees. The author measures the basal angle by drawing lines from the tuberculum sellae to the nasofrontal suture and to the anterior margin of the foramen magnum. *Basilar invagination or impression* means an upward bulging of the margins of the foramen magnum. It may be a congenital abnormality or secondary to softening of the bone about the foramen magnum. If the tips of the occipital condyles are seen at or above the foramen magnum line, basilar invagination must be present. The tip of the odontoid process of the axis is above Chamberlain's line in about one-third of normal individuals. If the distance is more than 3 mm., basilar invagination is almost surely present. A common finding in the series studied was a convex clivus. It was found in 12 patients in contrast to only 4 of the group with assimilation of the atlas. The 4 patients who had assimilation of the atlas and a convex clivus all had slight basilar invagination or platybasia as well.

The petrous tips were elevated in 16 of the 20 cases in which anteroposterior skull films were obtained.

Of the 11 examples of *separate odontoid process*, 2 were congenital abnormalities. In adults it is not possible to

tell whether a separate odontoid process is a result of a congenital anomaly or an ununited fracture. A striking finding was the marked gliding of the atlas on the axis during flexion and extension of the neck.

Chronic atlanto-axial dislocation may be due to the presence of a congenital anomaly. In this series, the dens lay from 5 to 17 mm. behind the anterior arch of the atlas, the distance averaging 11.5 mm. The depth of the spinal canal behind the dens was decreased.

Thirty-four roentgenograms; 4 tables.

HOWARD L. STEINBACH, M.D.
University of California

The Radiological Diagnosis of Lipoma of the Corpus Callosum. Poul E. Andersen. *Radiol. clin.* 22: 211-221, July 1953. (In English)

Due to the relatively greater translucency of fatty tissue, as compared with normal brain tissue, a lipoma will appear as a radiolucent area on plain roentgenograms of the skull.

In the author's case the postero-anterior and lateral roentgenograms showed an egg-shaped radiolucent area in the mid-line of the skull, corresponding to the location of the corpus callosum. Surrounding this area were crescent-shaped calcifications. The translucent area was best demonstrated in Towne's position, while the calcifications were most clearly shown in the lateral view. There were no signs of increased intracranial pressure.

Encephalograms showed a moderate filling of the lateral ventricles, which were markedly separated from each other by the tumor. The medial contours of the lateral ventricles exhibited a concave configuration. A cerebral angiogram revealed an anterior and upward displacement of the anterior cerebral artery.

The diagnosis of lipoma of the corpus callosum was made on the basis of the translucent area and crescentic calcifications demonstrated on the plain films, signs which are considered pathognomonic for this lesion.

Lipomata of the corpus callosum are rare benign tumors. It is of the greatest—often vital—importance that the correct diagnosis be made before surgical intervention is undertaken, as operation is usually followed by unfavorable and often fatal results. Surgery should be considered contraindicated unless the tumor produces serious manifestations. As the condition is without any characteristic clinical symptomatology, the responsibility for diagnosis rests with the roentgenologist.

Six roentgenograms.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

Radiologic Aspects of Pontine Gliomata. David Sutton. *Acta radiol.* 40: 234-248, August-September 1953.

The roentgen findings in 17 proved cases of pontine gliomas were analyzed. Routine films were normal in 15 cases, while 2 showed slight changes suggestive of raised intracranial pressure. Air encephalography is the examination of choice, though air ventriculography and positive contrast ventriculography were also used in this series. Tumors occurring in children (under sixteen years) showed a classical backward displacement of a central aqueduct or fourth ventricle. Changes in adults and adolescents were less typical and careful measurements of the aqueduct and fourth ven-

tricle were required to detect abnormalities. Myodil ventriculography confirmed some questionable cases. Angiography gives no positive information but may rule out confusing lesions.

Thirteen roentgenograms; 1 photograph; 2 drawings.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

Some Aspects of the Radiologic Diagnosis of Posterior Fossa and Supra-Sellar Tumours. Ingmar Wickbom and Philip Sheldon. *Acta radiol.* 40: 249-260, August-September 1953.

Encephalography carried out in the sitting position to demonstrate the fourth ventricle, aqueduct, and basal cisterns, often supplemented by vertebral angiography, is the proper approach to posterior fossa tumor diagnosis. These procedures have been described by Lindgren (*Acta radiol.* 31: 161, 1949, and 33: 389, 1950. *Abst. in Radiology* 54: 130, 1950, and 56: 604, 1951). They should be substituted for ventriculography whenever possible.

Nine cases are briefly presented to illustrate minor changes demonstrated by this technic. They include 2 cases of cholesteatoma; meningiomas of the pontine angle, the tuberculum sellae, and the olfactory groove; glioma of the pons; a cerebellar metastasis; 2 cerebellar hemangioblastomas.

The findings in these cases demonstrate that it is necessary to select the method of examination in each instance. In most cerebellopontine angle and mid-brain tumors, encephalography, by outlining the cisterns as well as the aqueduct and fourth ventricle, will make it possible to localize the lesion more accurately than can be done by ventriculography. Vertebral angiography may also be of use, especially where there is a vascular tumor of the cerebellum. In avascular tumors of the cerebellum, ventriculography usually gives most information, although it may be that, with further experience, examination of the cisterns and vessels in such cases may enable the diagnosis to be made with encephalography and vertebral angiography. While large suprasellar and subfrontal tumors may be shown easily by means of ventriculography and carotid angiography, small tumors may escape recognition unless air encephalography and special angiographic projections are used.

Twenty-four roentgenograms.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

A Report on the Radiographic Measurements of the Normal Sella Turcica in Filipinos. P. J. Garcia and A. M. Laxamana. *J. Philippine M. A.* 29: 413-414, August 1953.

Lateral radiographs of the skull were made on 168 cadavers which were free of pituitary disease, and the anteroposterior and vertical diameters were determined with calipers. The vertical diameter was measured from the floor of the fossa up to a line representing the anteroposterior diameter and not up to the diaphragma sella.

This study was undertaken to determine a standard for Filipinos. The range of the anteroposterior measurement was 8.12 to 16.95 mm., with an average of 12.53 mm. The range of the vertical measurement was 3.22 to 9.15 mm., with an average of 6.18 mm.

M. HARLAN JOHNSTON, M.D.
Jacksonville, Fla.

Apparatus for Serial Angiography. S. E. Sjögren and Georg Fredzell. *Acta radiol.* 40: 361-368, August-September 1953.

An automatic film changer to be used for cerebral angiography should fulfill the following requirements:

1. The size of the film should not be smaller than that usually employed.
2. It must be possible to carry out the percutaneous puncture with the patient in position. There must be room for an assistant and sufficient protection from irradiation.
3. Due regard must be paid to the necessity for various projections both in the anteroposterior and oblique planes.
4. With the correct technic, lateral views are taken with a horizontal projection of the central beam, and no exception to this rule should be made in serial angiography.
5. It must be possible to obtain test films which can be developed immediately.

A special apparatus designed to fulfill these requirements is described in this article. It permits the taking of as many as thirty roentgenograms at a maximum rate of six per second.

Five illustrations. HOWARD L. STEINBACH, M.D.
University of California

THE CHEST

Further Empirical and Experimental Studies with Joduron Bronchography. H. U. Zollinger and F. K. Fischer. *Schweiz. med. Wchnschr.* 83: 645-656, July 11, 1953. (In German)

Water-soluble contrast material is now thoroughly accepted as the best for bronchography. While Joduron is known to be relatively safe, occasional reports of lung damage have appeared. It is this possibility of damage that is here investigated.

One hundred human lungs, which were surgically removed anywhere from twenty-nine hours to nine months after Joduron bronchography, were examined in detail both grossly and microscopically. Ninety-five of the specimens showed no residual contrast material and particularly no change which could be ascribed to bronchography. Specific search was made for carboxyl methyl cellulose, the ingredient of Joduron which Vischer described as the offender (*Schweiz. med. Wchnschr.* 81: 54, 1951. *Abst. in Radiology* 57: 900, 1951).

Five lungs showed residual evidence of the medium in the diseased portions or the immediately adjacent parenchyma. In 2 of the 5 there was simply persistence of carboxyl methyl cellulose within the alveoli, accompanied by a few phagocytes, the changes being noted on a microscopic level. Two other lungs contained tiny, widely spaced Joduron granulomata with foreign-body giant-cell infiltration. The granulomata were so small they could not have had any clinical significance. The changes in the one lung remaining consisted of a chronic interstitial pneumonia of the lingula, which was the site of extensive pulmonary cysts. At the time of bronchography, the catheter was accidentally pushed into the parenchyma of the diseased lingula and the entire amount of the medium, 40 c.c., was injected.

A group of ten rabbits were subjected to bronchography with a technic as nearly equivalent as possible to that used in man. Inspection of the lungs shortly thereafter revealed no untoward changes. The me-

dium was, of course, present in the bronchi and some of the alveoli. Forced lobar flooding was produced in a second group. These lungs revealed traumatic ruptures and hemorrhage, but no necrotizing chemical reaction. A third group underwent forced alveolar filling from a catheter wedged tightly in a bronchus. These rabbits illustrated the already known fact that methyl carboxyl cellulose introduced into an alveolus remains there for some time as a passive foreign body. The total animal studies confirmed previous observations that practically none of any contrast medium injected into a bronchus is absorbed; elimination is by expectoration. In man, likewise, residual Joduron is rarely found in normal lungs. It is retained only in lungs so diseased that expectoration is blocked.

Adverse reactions to water-soluble material containing carboxyl methyl cellulose are rare and of little consequence. The items of importance are technical: avoidance of undue force through a catheter wedged into a bronchus; avoidance of perforation of a bronchus with resultant interstitial injection of the medium; avoidance of excessive flooding of a segment.

Sixteen roentgenograms; 14 photomicrographs; 5 photographs.

WM. F. WANGNER, M.D.
Royal Oak, Mich.

Bronchography with a Rapidly Eliminated Compound "Dionosil." Christopher Cummins and C. P. Silver. *Brit. J. Radiol.* 26: 435-440, August 1953.

Bronchograms were made with 50 per cent Dionosil, a compound containing the propyl ester of 3,5-diiodo-4-pyridone-N-acetic acid, in aqueous suspension in 14 patients and in arachis oil in 12 patients.

The aqueous suspension was much more irritating than the oil suspension, and coughing made the taking of films difficult. There was little spread into the alveoli, and disappearance of the medium was complete in forty-eight hours. The oily suspension caused no more trouble than other iodized oils. It was not eliminated as rapidly as the aqueous suspension but probably more rapidly than the commonly used media, disappearing in ninety-six hours. Satisfactory bronchograms were obtained with both preparations.

Five specimens of lung were examined histologically from four to seventeen days after bronchography. The changes seen were not as pronounced as following the iodized oils in general use.

Three roentgenograms. SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Clinical Findings and Anatomical Changes in the Lungs Following Bronchography with Perabrodil BR (Viscosity 60 per cent). H. W. Weber (Clinical Section by B. Löhr). *Fortschr. a. d. Geb. d. Röntgenstrahlen* 79: 168-179, August 1953. (In German)

Changes within the lungs, in the form of oil-resorption granulomas with fibrosis and subsequent shrinking, have been observed following bronchography with iodized oil, especially in cases of chronic pulmonary disease. In the presence of acute lesions, local necrotic areas have occasionally been encountered. More recently, water-soluble media have been used, as Umbradil (Viskös B), Joduron B, and Perabrodil BR. In the preparation of these, a cellulose derivative is added to the iodine to obtain adequate viscosity. The two substances are not bound chemically but constitute a simple mixture. When such media are employed, the contrast substance

disappears from the bronchi in two to four hours and is excreted by the kidneys. The viscous component, however, remains and may act as a foreign body. To clarify the mechanism involved, observations have been made on animals and man.

Injections of Perabrodil BR (viscosity 60 per cent) were made into the right lower lobes of 21 rats; 6 rats were injected with simple physiological saline, and 14 were reserved as controls. Results were compared with 15 human lungs obtained at operation.

The animal experiments were considered rather inconclusive, but the viscous material was demonstrated in the alveoli and finer bronchioles, as well as in the secretions. A moderate hyperemia was also present, with increase of white cells. This appeared to indicate that the viscous substance remains after complete excretion of the iodine. In the operative specimens, foreign-body granulomas were identified in 4 cases, with phagocytic cells, foam cells, and giant cells. Mucus was present in the finer bronchioles, and in places bronchiolitis obliterans was present. In the 4 patients with granuloma, peripheral (alveolar) filling had been obtained.

Although the author does not regard the findings as conclusive, he recommends that in the use of water-soluble iodine preparations for bronchography (a) peripheral filling be avoided wherever possible and (b) premedication be used in doses that will not completely depress the cough reflex.

Two roentgenograms; 2 photomicrographs.

E. S. SPACKMAN, M.D.
Fort Worth, Texas

Prevention of Iodism in Bronchography by Use of ACTH. Case Report. Felix R. Park, Robert T. Cronk, and Gerald E. Cronk. *Dis. of Chest* 24: 219-225, August 1953.

Iodism is not an infrequent complication of bronchography and often precludes additional studies. The reaction occurs shortly after instilling the oil and subsides in twenty-four to forty-eight hours. It consists of urticaria, salivary gland swelling, and occasionally asthma. A skin eruption two to three weeks later has been noted.

The authors describe the case of a young male in whom iodism was prevented by the use of ACTH. Lipiodol bronchography was first done and the patient experienced sore throat, submaxillary gland swelling, urticaria, and fever. A second examination was done a few days later, 25 mg. of ACTH having first been given, without any untoward reaction.

An oral test dose of 10 drops of a saturated solution of potassium iodide should be given three to four days prior to bronchography to test for iodine sensitivity.

The technic of bronchography and the merits and disadvantages of Lipiodol and of a water-soluble product are briefly discussed. ACTH may also be valuable in other procedures using iodine preparations.

Three roentgenograms.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

The Problem of Surface Anesthesia of the Upper Air Passages. F. Böhm. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 79: 192-196, August 1953. (In German)

For anesthesia preliminary to bronchography, the author adds Adhaegon, a synthetic protein obtained

from the chemical works of A. G. Heyden of Munich, to a 1 per cent Pantocain solution. The preparation, stored in a cool place, keeps well for two months. Seven hundred bronchoscopic and bronchographic examinations were done under this type of anesthesia without untoward effect. Preliminary chemotherapy and antibiotic medication are recommended, however, in inflammatory conditions of the throat and trachea. In very young or feeble patients, not over 1.5 c.c. of the anesthetic solution is used. Care is taken not to exceed 45 mg. of Pantocain, 60 mg. being considered a minimum lethal dose.

The addition of Adhaegon prolongs the action of the anesthetic; there is less absorption, and smaller quantities may be used. The entire anesthetic procedure, including swabbing or spraying the throat and larynx and direct instillation into the trachea, requires about four minutes. This was found to be quite satisfactory for a forty-five minute examination. Addition of adrenalin did not appear to produce any increase in toxicity.

[Use of a preparation for which the formula is not given prevents a satisfactory estimate of this procedure. The article is reviewed in case there are workers in this country developing a preparation with similar objectives.—E. W. S.]

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Contribution to the Early Diagnosis of Bronchial Carcinoma by Simple Contrast Demonstration of the Bronchial Tree. E. Liese, W. Mertin, G. Fruhmahn, and B. Klun. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 79: 179-187, August 1953. (In German)

Bronchogenic carcinoma is frequently recognized only after the onset of metastasis, lymphatic spread, or formation of an inflammatory zone about the tumor with atelectasis. In the authors' opinion, operative success depends on recognition of the lesion at the earliest possible stage. He considers cough, blood-streaked sputum, and fairly constant chest pain as sufficient indication for complete studies.

For centrally situated and hilar lesions a relatively simple procedure has been developed that may be used routinely and is less time-consuming than conventional routine bronchography. Small doses of Luminal and atropine are given and 2 per cent Pontocaine, approximately 0.5 c.c., is swabbed or sprayed into the throat twenty minutes before the procedure. Two to three cubic centimeters of 2 per cent Pontocaine, without adrenalin, is introduced through a plexiglass spatula which is placed over the epiglottis, and 0.5 to 1.0 c.c. is dropped into the trachea. Anesthetization of the tracheal bifurcation is particularly important. Not more than 3.0 c.c. of Pontocaine is ever required. Five to eight cubic centimeters of the contrast medium is injected, and the patient is turned and tilted in various directions, to insure filling of the main stem bronchi on the side examined, as well as some of the finer divisions. To obviate possible spread of infection by these methods, penicillin-streptomycin is administered two hours before examination. No untoward symptoms have been observed. Very slight parotid swelling was noted in a few cases. As a further precaution, nothing is given to the patient to eat or drink for at least an hour after the examination, because of depression of the swallowing reflex.

This procedure is recommended as a simple routine in centralized questionable lesions, more complete methods

being reserved for selected cases. It has been found to cause relatively little inconvenience to the patient.

Seven roentgenograms; 2 drawings.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Roentgenologic and Clinical Aspects of Lung Resection (Operability and the Postoperative Course). H. J. Gombert, H. Laux, and H. Winguth. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 79: 157-168, August 1953. (In German)

This report, based on 159 lung resections performed since early 1950, seeks to clarify judgment as to operability and prognosis in bronchial carcinoma.

Centrally situated bronchogenic carcinoma is usually difficult to diagnose in its earlier stages. The only roentgen indication is hilar enlargement, which may also be produced by infectious processes, enlarged lymph nodes, etc. Bronchoscopy and bronchography are often helpful in establishing the diagnosis. Tomography is especially recommended in the search for mediastinal metastases. In the moderately advanced stage, changes in ventilation become apparent, secondary to obstruction of the major bronchial divisions. Emphysema, atelectasis, a mass, abscess formation, or bronchiectasis may be recognized. In the final stage, with involvement of the main stem bronchus, total atelectasis is seen on one side, with pleuritis, phrenic paralysis, contraction of the thorax, and mediastinal displacement.

Peripheral tumors, including sulcus tumors, may be confused with tuberculosis in the early stages. Bronchogenic carcinoma in the central region may simulate lipoma, fibroma, or cylindroma. In the lower lung field, confusion arises with diaphragmatic hernia and with pulmonary, pericardial, and echinococcus cysts.

Judgment as to probable operability is more important than differential considerations. In the authors' clinic, the radical operation is favored in most cases, except for small peripheral lesions and those proved to be benign. Lobectomy is preferred for local cystic degeneration, bronchiectasis, and localized tuberculosis. Partial resection is the operation of choice for small peripheral abscesses, removal of foreign bodies, and small solitary lung cysts.

The authors list the more common postoperative complications as emphysema of the neck, mediastinum, etc., changes of tension and respiratory embarrassment as the wound is closed, and pressure changes within the thorax, often resulting in increased tension in the lesser circulation and cardiac strain.

In older patients, convalescence is more prolonged and more difficult. The importance of roentgenologic follow-up during the recovery period is stressed, particularly the use of bronchography to determine the condition of the stump and to identify any pathological changes at the earliest possible moment. In the authors' experience about 25 per cent of patients with operable disease were symptom-free for one year.

Thirteen roentgenograms; 1 photograph.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Cancer of the Lungs with Metastases in the Lungs. Nándor Rotkóczy. *Radiol. clin.* 22: 347-361, July 1953. (In German)

Primary cancers of the lung metastasize frequently via the blood stream as well as by way of the lymphat-

ics. Hematogenous spread usually occurs into the liver and bones but also into other organs. Invasion of the lymphatics leads to regional lymphadenopathy. Pulmonary metastasis of lung cancer is considered a rarity.

Two cases of cancer of the lungs with metastases also involving the lungs, and a third case, still under observation, of carcinoma of the trachea with large, round secondary lesions in the lungs, are described.

For the first two cases it is assumed that spread occurred by way of the lymphatics (lymphangitis), although implantation by aspiration is also a possibility. The round, dense shadows in the lungs in the third case are considered as due to an internal hematogenous spread *via* the bronchial veins or to bronchogenic metastases.

Seven roentgenograms.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

The Reliability of Chest Roentgenography and Its Clinical Implications. J. Yerushalmy. *Dis. of Chest* 24: 133-147, August 1953.

The author reviews earlier observations on the reliability of chest x-ray interpretation (see, for example, Garland, *et al.*: *Radiology* 58: 161, 1952). These investigations have been related to the (1) detection of lesions, (2) description and classification of a lesion, (3) serial roentgenograms, and (4) dual readings of single roentgenograms. In these general categories there has been found a marked and rather alarming lack of agreement among expert readers.

The present study concerns dual readings of serial roentgenograms. Two films, approximately three months apart, on patients with proved tuberculosis, formed a pair. One hundred forty-two film pairs were interpreted by six qualified specialists and classified simply in one of three groups: "better," "no change," or "worse." The findings in essence were that two readers will agree in two-thirds of the cases; the remaining third can then be submitted to another interpretation or may be classified as "roentgenographically indeterminate."

The reader is referred to the original article for a detailed statistical analysis of the findings.

Nine tables.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

"Initial Foci," a Special Group of Minimal Tuberculosis. Prognosis and Treatment. Erik Hedvall. *Dis. of Chest* 24: 148-156, August 1953.

The so-called "initial foci" constitute the first changes in post-primary tuberculosis and form the starting point for ordinary pulmonary tuberculosis. With his associate, Malmros, the author made an eight-year study covering 3,336 individuals, in order to detect the first manifestations of primary and post-primary disease. In all, 151 cases of primary tuberculosis in adults were encountered and in 104 of this number a positive tuberculin test was the only sequela. In the remaining 47 cases, various forms of tuberculosis developed, as erythema nodosum, primary complex, tuberculous adenitis, pleurisy, and miliary tuberculosis.

In 19 cases post-primary tuberculous changes in the lungs were observed roentgenographically. The "initial foci" were small (1-5 mm.), rather irregular spots, sometimes ill-defined and with a tendency to coalesce.

They are most frequently encountered in the supra-clavicular region or the first intercostal space and probably develop hematogenously. They do not, as a rule, give rise to clinical findings. While cultures from gastric lavage often show growth of tubercle bacilli, ordinary sputum samples are frequently negative. The foci may heal and calcify or they may, after a short period of quiescence, show a progression of the disease. The importance of recognizing this is stressed, as the "initial foci" are often misinterpreted as healed lesions or of no significance.

The author's cases were followed and several illustrative histories are presented. After fourteen years, 3 of the patients had died of tuberculosis; the remaining 16 were well, though 4 of these had required artificial pneumothorax for recovery. It is concluded that, though the "initial foci" may not require treatment, they should be carefully followed. If progression occurs, artificial pneumothorax should be instituted before cavities appear. Chemo-antibiotic treatment (streptomycin and PAS) has proved effective in this stage of the disease. Segmental operation is not advised in this early type of tuberculosis.

Eleven roentgenograms.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Phthisiogenetic Considerations Based on Tomographic Analysis of 320 Consecutive Cases of Localized Pulmonary Tuberculosis in Adults. Hugo Adler. *Dis. of Chest* 24: 191-204, August 1953.

The tomographic findings in 320 cases of localized open pulmonary tuberculosis in adults are analyzed as to the anatomical location of the lesion and the incidence of calcification. A detailed tomographic study in the anteroposterior, lateral, and (occasionally) oblique positions was done. A distinction was made between dominant and secondary lesions.

The great majority of the dominant lesions were found to be situated in the upper and dorsal portions of the lungs. The incidence of calcification was 60.5 per cent, with 47.0 per cent in the involved area of lung parenchyma. This was thought to indicate that about one-half of the analyzed cases should be considered as reactivations of previous infection.

The reader is referred to the original article for the details of this excellent study and for a comprehensive review of the literature.

Five tables.

SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Intralobar Pulmonary Sequestration. Gladys Boyd. *Dis. of Chest* 24: 162-172, August 1953.

Intralobar sequestration is a congenital anomaly in which displaced lung tissue occurs in the chest cavity with hypoplastic alveoli and dilated bronchi, giving a honeycomb or cystic appearance. The displaced lung is the recipient of a systemic vascular supply, usually from the aorta. The cause of the anomaly is unknown; it is probably due to the amputation of a primordial lung bud by an aberrant artery in the 4 to 14-mm. embryo.

The lesion makes itself known when it becomes infected or when the adjacent lung becomes diseased. It may be the cause of hemoptysis. The x-ray film demonstrates a mass of considerable density, often containing cystic areas. The bronchogram usually shows a

mass extraneous to the bronchial tree. Adjacent lung may show bronchiectasis. The only effective therapy is surgical removal.

The author presents six cases of intralobar sequestration in children, with a detailed description of the pathological findings.

Two roentgenograms; 1 photograph; 1 drawing.
SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Cavitation Within Bland Pulmonary Infarcts. Philip H. Southeray and Bernard J. O'Loughlin. *Dis. of Chest* 24: 180-190, August 1953.

In a series of 100 cases of pulmonary infarction, radiologic evidence of cavitation was found in 5. While this is not one of the common sequelae of infarction, it must be recognized. It does not seem to be a grave prognostic sign. Though these lesions are not frank abscesses, they undoubtedly cannot remain sterile for long. Antibiotic therapy can apparently control infection so that healing occurs without surgical treatment.

The authors review the literature and discuss the pathology and clinical findings in pulmonary infarction. Several illustrative cases are presented.

Ten roentgenograms; 1 diagram.
SEYMOUR A. KAUFMAN, M.D.
Boston, Mass.

Intrathoracic Hibernoma. Third Reported Case. J. Winthrop Peabody, Jr., Joseph Ziskind, Howard A. Buchner, and Augustus E. Anderson. *New England J. Med.* 249: 329-332, Aug. 20, 1953.

Animals have a "hibernating gland" composed of multiloculated fat cells. An homologous structure in human beings is questionable, but occasionally in embryos and even adults a tissue of similar brown color and microscopic pattern is found. The evolution of characteristic tumors from this brown fat has been validated by reports of 18 previous cases. The case reported here is believed to be the third of a hibernoma arising in the chest.

A 31-year-old Negro had a slowly enlarging area of density in the lateral portion of the left upper lung field, without symptoms. This was a smooth, round, sharply demarcated opacity, $4 \times 3 \times 2$ cm., along the lateral margin of the first left anterior intercostal space. It was located posteriorly. The lungs were otherwise clear. The shadow had been present for four years (x-ray evidence), tripling its size in that time. Benign pleural mesothelioma and neurofibroma were the diagnostic possibilities considered. Increasing size prompted exploratory thoracotomy. Roentgenographic follow-up for eighteen months after surgery revealed no recurrence.

The gross tumor was tawny, brown yellow, and greasy. Microscopic study showed multiple lobules with two distinct cell types, the larger being typical signet-ring nucleated fat cells. Smaller multilocular cells with central nuclei were more numerous and occurred in closely packed masses separated by the adult fat cells with the signet-ring nuclei. The smaller cell is typical of hiberna tissue in animals, where it is found projecting from a primary mass in the superior mediastinum into the axillae, neck, back, perirenal, and retroperitoneal tissues, inguinal and gluteal regions. Review of the earlier reports shows that the tumor has occurred on the posterior aspect of the chest in 4

out of 18 cases, in the axilla in 3, within the chest in 2, and in the posterior part of the neck, popliteal space, and lumbosacral area in 1 each. Unfortunately the location was poorly defined or not mentioned in the remaining reported cases. No mediastinal hibernoma has yet been described. Malignant transformation is a theoretical possibility, not as yet recognized.

One roentgenogram; 1 photomicrograph.
D. deF. BAUER, M.D.
Coos Bay, Ore.

Cyst Formation in Graphite Pneumoconiosis. H. Müller. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 79: 205-210, August 1953. (In German)

This report is based on examinations of 71 graphite workers with light to moderate exposure. Fourteen had pathological changes within the lung fields, and 19 others showed minimal fibrotic changes not characteristic of pneumoconiosis. Analysis of the dust showed the content of silica (free and bound) to be 3.038 per cent.

A large percentage of the inhaled dust is undoubtedly eliminated by coughing, leaving a relatively small amount to be phagocytized in the alveoli, transported to the regional nodes, especially the pleural nodes, and deposited in the region of the pulmonary vessels and about the bronchioles.

In experiments on rats, Ray, King, and Harrison (*Brit. J. Indust. Med.* 8: 68, 1951) described the progressive changes following graphite inhalation, as follows: (a) minimal fibrosis, (b) silicotic nodule formation, (c) destruction of the elastic tissues, (d) interstitial fibrosis, (e) closure of the smaller vessels with tissue ischemia and resulting cyst formation in chronic cases. Associated emphysema was often present.

The author reports 3 cases with cyst formation. These cysts cannot be distinguished in their earlier stages, as they appear opaque on the x-ray film. When a cyst ruptures into the bronchial tree, however, a black-brown material is coughed up and the typical air-filled cyst may then be recognized.

Five roentgenograms; 1 photograph.
E. W. SPACKMAN, M.D.
Fort Worth, Texas

Chronic Pneumopathies and Rheumatism. F. Martin and G. H. Fallet. *Schweiz. med. Wchnschr.* 83: 776-782, Aug. 22, 1953. (In French)

Attention is called to the recent report of Caplan (*Thorax* 8: 29, 1953) which relates the association of chronic rheumatism and silicosis. While the pathogenesis of the osteoarthopathy of Pierre Marie has not been fully explained, it does illustrate the occurrence of skeletal changes in pulmonary affections. The authors have encountered 2 cases of nodular silicosis, 1 of sarcoidosis, and 1 of tuberculosis which were associated with chronic rheumatism (rheumatoid arthritis) and believe that in rare instances the association may be due to some factor other than chance. No reasonable explanation has been found.

Eight roentgenograms; 1 photograph.
CHARLES M. NICE, M.D.
University of Minnesota

Contribution to Besnier-Boeck-Schaumann Disease. K. Werner. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 79: 210-216, August 1953. (In German)

Boeck's sarcoid is of more frequent occurrence than has been generally recognized in the past. The condi-

tion is characterized by lack of change over very long periods of time and frequently very little in the way of clinical symptoms. The diagnosis is difficult when the lesion is limited to the lung and mediastinum.

Various classifications of the lung lesions have been suggested, the least complex being that of Hartweg, who divided them into (1) hilar, (2) reticular, (3) miliary, (4) indurative-infiltrative, and (5) nodular forms.

Lesions of bone occur with greatest frequency in the hands and feet and consist of cystic changes near the articular surface and in the central portion at the end of the shaft, with no periosteal reaction. The joints are not affected. Occasionally the terminal phalanges may be partially absorbed.

The author reports several cases referred to him for treatment as pulmonary or mediastinal tumors. One patient showed a most unusual involvement of the stomach, demonstrable as an oval defect, moderately well outlined, causing spreading of the rugae, which were thickened and irregular.

The author agrees with others that in all probability the disease is an atypical form of tuberculosis.

Seven roentgenograms. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Calculation of the Size of the Heart by Means of the Transverse Diameter Sum. H. Ludwig and D. D. Goridis. *Radiol. clin.* 22: 293-309, July 1953. (In German)

For the calculation of the size of the heart the use of the sum of the transverse diameter and the greatest horizontal depth diameter is recommended. Less than ten minutes are required for this method if the necessary points are marked by the orthodiagraphic method and tables of normal average values are used. Comparison with heart volume calculation according to the modified Rohrer-Kahlstorf formula shows that the close relationship of the transverse diameter sum to various body measurements makes it possible to predict exact normal values.

The use of the transverse diameter sum is in the authors' opinion as good as the more complicated volumetric method.

One drawing; 10 tables.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

Pericardial Effusion Associated with Myxedema
Paul A. Marks and Betty S. Roof. *Ann. Int. Med.* 39: 230-240, August 1953.

The suggested pathologic changes in myxedema heart include cardiac dilatation, fibrosis of the myocardium, interstitial edema of the myocardium, and pericardial effusion. Two cases with proved pericardial effusion are described in detail. Manifestations of "right-sided failure," marked enlargement of the cardiac silhouette as shown roentgenographically, and electrocardiographic changes reverted toward normal with the disappearance of the effusion following thyroid therapy. These changes suggest that the effusion played a major role in the production of the cardiac dysfunction. This view is supported by case records in the literature of myxedema associated with pericardial effusion proved either by paracentesis or at autopsy. Of 44 cases reported, 32 had sufficient data to allow comment. In all 32 cases, cardiac abnormalities regressed on thyroid therapy in from ten days to nine months.

Among 25 cases of myxedema with pericardial effusion for which data on this point were available, 13 had associated pleural or peritoneal effusions or both. Pericardial as well as other serous cavity effusions have been observed in myxedema induced by thyroidectomy in rabbits, sheep, and goats.

The mechanism of production of effusions into serous cavities and of interstitial edema in hypothyroidism is not well understood. A possible explanation of the interstitial accumulation of fluid is increased capillary permeability. The high protein content of the effusions is compatible with this hypothesis. It may be that fluid retention in myxedema is attributable to the interstitial elaboration and accumulation of hydrophilic substances.

It appears most likely that pericardial effusion plays a frequent and important role in the genesis of cardiac symptoms and signs associated with myxedema. In patients with long standing and recurrent pericardial effusions, the diagnosis of myxedema must receive serious consideration.

Three roentgenograms; 3 tables.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

The Heart in I^{131} -Induced Myxedema. Comparison of the Roentgenographic and Electrocardiographic Findings Before and After the Induction of Myxedema. George S. Kurland, Roland E. Schneekloth, and E. Stone Freedberg. *New England J. Med.* 249: 215-222, Aug. 6, 1953.

Myxedema heart may occur spontaneously, as the result of thyroidectomy or following I^{131} -induced hypothyroidism. The use of I^{131} in euthyroid patients with intractable angina pectoris and congestive heart failure has afforded the opportunity of studying the effects of prolonged, controlled hypothyroidism on the cardiovascular system. Increase in heart size is frequently found in cases of spontaneous myxedema. Heart size decreases with thyroid medication and increases on its withdrawal.

Twenty-seven patients with iodine-induced myxedema were shown to be distinctly hypothyroid. Ten of 13 patients who obtained relief of angina pectoris exhibited no increase in heart size after two to forty-eight months of hypometabolism. Two other cases showed no change in heart size for twenty-six and thirty-eight months, respectively, but subsequently showed enlargement during exacerbation of symptoms. Five of 6 patients with angina pectoris which was not benefited by I^{131} therapy showed progressive increase in heart size. Several patients with angina pectoris and congestive failure showed marked therapeutic benefit despite progressive and marked cardiac enlargement from the myxedema.

The development of myxedema was accompanied by a decrease in electrocardiographic voltage, flattening or inversion of T-waves, and a slight decrease in the QT interval. These changes regressed after administration of small doses of thyroid.

This study indicates that prolonged, controlled I^{131} -induced hypothyroidism does not produce myxedema heart if this be defined as a condition precipitating congestive heart failure or angina pectoris, accompanied by marked EKG and x-ray changes.

Six roentgenograms; 3 tables.

D. deF. BAUER, M.D.
Coos Bay, Ore.

Beriberi Heart Disease. Aaron Burlamaqui Benchimol and Paul Schlesinger. *Am. Heart J.* 46: 245-263, August 1953.

The authors describe their findings in 22 cases of beriberi heart disease diagnosed within a three-year period in the city of Rio de Janeiro. The patients were all males, chronic alcoholics, and all but 6 were engaged in occupations requiring considerable physical exertion, which would increase thiamine requirements. While there was an associated dietary deficiency in about half of the cases, all the patients were well nourished.

Excessive intake of alcohol predisposes to beriberi heart disease by inducing a thiamine deficiency, but since the incidence of chronic alcoholism is far greater than that of beriberi heart disease, it is apparent that other factors must play a part, such as infectious diseases, physical exertion, thyrotoxicosis, etc. The clinical picture is often reversible following large doses of thiamine, even though the alcoholic intake is maintained.

The signs and symptoms of cardiac beriberi vary considerably. In the authors' series, dependent edema was a striking feature, being present in all but 2 instances as an initial sign. Most of the patients complained of dyspnea at some time during the course of the disease. Paroxysmal dyspnea followed by orthopnea occurred as an isolated initial symptom in 2 cases. Pulmonary congestion was observed in 19 patients; only 5 had ascites. Pleural effusion was present in 3. Hepatomegaly was found in all. A mild degree of cyanosis was observed in less than one-third of the series.

In the majority of the cases, soft systolic murmurs were audible; in only 4 were diastolic murmurs heard. An accentuated pulmonic second sound was usually present. Transient gallop rhythm occurred during heart failure. Tachycardia was the rule, the rate being over ninety in all but 6 cases.

Polynucleitis was present in 20 patients, and pellagra in 3.

The roentgen findings in cardiac beriberi are not typical. The heart is enlarged. In the oriental form of the disease the enlargement has been considered due to enlarged right chambers, with a prominent pulmonary conus, simulating either a mitral stenosis or an aneurysmal dilatation of the pulmonary artery. In the Brazilian series, left ventricular enlargement and pulmonary congestion were equally present in most cases. In 9 patients the heart was of normal size on discharge. The cardiac dilatation may be partially or completely reversible, depending upon the degree and duration of myocardial involvement.

The significant diagnostic features of cardiac beriberi may be summarized as follows: (1) a history of chronic alcoholism; (2) presence of other signs of thiamine deficiency; (3) absence of other etiological factors of heart disease; (4) favorable results following thiamine medication.

Sixteen roentgenograms; 2 photomicrographs; electrocardiograms.

HENRY K. TAYLOR, M.D.
New York, N. Y.

Persistent Truncus Arteriosus. Report of Two Cases with Right Aortic Arch. Richard D. Rowe and Peter Vlad. *Am. Heart J.* 46: 296-308, August 1953.

The authors give the case histories and autopsy findings for two patients with persistent truncus arterio-

sus, a rare congenital malformation, usually resulting in death in very early life. In these two instances, there also were right aortic arches, and the pulmonary arteries arose directly from the single vessel.

The first patient was a white male child, who lived twenty-four days; the second, one of white twin girls, lived three and a half months. Both were dyspneic and cyanotic, with rapid pulse and systolic murmurs.

The first child had a large heart, which occupied most of the left chest. A bronchogram showed normal bronchial architecture on the right side; on the left side the left main bronchus was smaller and elevated and the bronchial branches were smaller. At autopsy the left lung was found to be atelectatic and unfissured; the right lung was composed of five lobes. The heart was enlarged, with a high septal defect and a single exit trunk for both ventricles for a distance of 6 mm. The aortic arch and descending aorta lay on the right side. There were three pulmonary veins leading to the left auricle.

The second patient also had a large heart. The right-sided aorta was recognized after a barium swallow. Angiocardiography demonstrated the aorta and pulmonary arteries 0.8 second after the beginning of the injection. Autopsy revealed a high septal defect with a single exit trunk over both ventricles for a distance of 11 mm.

A persistent truncus arteriosus presents a cardiac contour referred to as a "sitting duck," usually with a decreased vascularity to the lungs. This appearance may be simulated by an extreme tetralogy of Fallot or pulmonary atresia.

Nine figures, including 8 roentgenograms.

HENRY K. TAYLOR, M.D.
New York, N. Y.

THE DIGESTIVE SYSTEM

The Management of Upper Gastrointestinal Hemorrhage. Thomas A. Warthin, Frederick P. Ross, Donald V. Baker, and Egon Wissing. *Ann. Int. Med.* 39: 241-253, August 1953.

Of the 29,206 patients admitted to the West Roxbury Veterans Administration Hospital (Boston) in a five-year period, 462 entered for treatment of upper gastrointestinal tract bleeding. Of these, 246 were found to have had a "massive" or "severe" hemorrhage, *viz.*, a fall in red blood cell count to 3 million or less, hemoglobin of less than 8.0 gm. per 100 c.c., or a state of blood volume insufficiency requiring immediate replacement of at least 1,000 c.c. The report is based upon this massive bleeding group. Only one-third of these patients were over fifty years of age.

Six of 184 ulcer patients died, a gross mortality rate of 3.2 per cent. Of 161 patients with a duodenal ulcer, 2 died, while of 20 patients with gastric ulcer 4 died, 2 without operation, within twelve hours of admission, and a third shortly after operation, which had been postponed for three days. These deaths, occurring early in the study, make it apparent that a bleeding gastric ulcer constitutes a graver and more serious hazard than a duodenal ulcer. In the five years, 32 emergency or urgent operations (17 per cent) were performed, with a single death.

The authors' program of management of upper gastrointestinal bleeding entails emergency x-ray examination of all patients over forty as soon as shock has been controlled. In 1946-51 100 roentgen examinations

were performed within seventy-two hours of admission. More recently 75 examinations had been made within twelve hours of admission, with equal freedom from renewed bleeding. Inability to swallow is a contradiction to the procedure, and in any event it must be done without heavy palpation of the patient.

Esophageal varices are well shown with Rugar barium. Gastric ulcers are also best demonstrated after a single swallow of barium. Duodenal ulcer craters are harder to demonstrate, but the deformity of the duodenal cap is easily seen.

The Sengstaken double balloon tube has proved to be of great assistance in diagnosis, as well as treatment. When properly in position, it will check massive bleeding from esophageal varices. When two sources of bleeding are possible, e.g., esophageal varices and peptic ulcer, the tube is passed and both balloons are inflated. Persistence of bleeding, if the balloons are shown by x-ray to be in the proper position, is presumptive evidence that the source is an ulcer and not varices. Barium can also be introduced into the stomach *via* the tube and an ulcer demonstrated, if roentgenograms have not already been obtained.

One-half of the patients with gastric ulcer either died or underwent emergency operation. Massive bleeding from duodenal ulcer plus such complications as age, cardiovascular disease, hepatic or personality disorders, or local abnormalities, may be a serious hazard, but is controlled by surgery. Ulcers located beyond the duodenal bulb, so-called postbulbar ulcers, are particularly liable to uncontrollable bleeding and are regarded as second to gastric ulcer as an indication for early operation.

If no source of bleeding is found by various examinations, and the hemorrhage continues at a rate of over 3 liters of blood a day for more than forty-eight hours, further postponement of surgery is not justified. The operation should include both exploration, to determine the highest level of blood within the gastrointestinal tract, and subtotal gastric resection.

Massive hemorrhage from esophageal varices associated with Laennec's cirrhosis has had an extremely high mortality rate (80 per cent). At the present time, the authors are embarked on a program of immediate tamponade, followed by surgical ligation of the varices at the first evidence of bleeding after deflation of the balloons, and large doses (up to 800 mg. per day) of cortisone. The latter has been thought by some to be lifesaving in severe infectious hepatitis.

Twenty roentgenograms; 1 photograph; 1 graph; 3 tables.

STEPHEN N. TAGER, M.D.
Evansville, Ind.

Gastro-oesophageal Regurgitation: Its Incidence and Relation to Symptoms. L. Werbeloff and C. Merskey. *South African M. J.* 27: 739-741, Aug. 29, 1953.

Two hundred consecutive patients were examined roentgenologically for gastroesophageal regurgitation. The clinical histories and complaints in this group were evaluated independently, without knowledge of the radiologic findings. This was done in an effort to determine the incidence of regurgitation and whether reflux alone presents a typical symptom pattern, as suggested by Lawler and McCreath (*Lancet* 2: 369, 1951. *Abst. in Radiology* 59: 283, 1952).

All patients were examined supine in the left anterior oblique position, and standing with knees extended and

trunk flexed. During the first maneuver the patient was required to hold the legs unsupported above the table and simultaneously cough to increase intra-abdominal pressure; during the second, coughing alone was employed for this purpose. Both maneuvers were performed twice, so that in each case the esophagus was observed for several minutes, including intervals of relaxation, during which the patient inhaled deeply, between the straining maneuvers.

Gastroesophageal reflux was observed in only 13 of 200 patients, an incidence of 6.5 per cent. Only four of these gave a history of substernal or epigastric pain related to posture. Seven patients had similar postural pain but no demonstrable reflux. Three of the 4 patients with postural pain and reflux had sliding hiatus hernias.

The authors conclude that there is no correlation between substernal pain related to posture and the occurrence of gastroesophageal regurgitation observed at fluoroscopy. Substernal or epigastric pain associated with postural changes is a feature of sliding hiatus hernia which is often associated with regurgitation.

Two tables.

R. F. LEWIS, M.D.
Cleveland Clinic

Difficulties in the Early Diagnosis of Carcinoma of the Esophagus. R. Nissen. *Radiol. clin.* 22: 320-323, July 1953. (In German)

On the basis of his practical experience the author discusses some sources of error in the interpretation of radiological and esophagoscopy findings. From the roentgen standpoint, it is often overlooked that barium mixture and even paste may pass a small non-obstructing tumor without showing a filling defect or interruption of the relief pattern. The customary wait of one or two months for a control examination, when no lesion is found on the first x-ray studies, is the more frequent cause of unnecessarily delayed diagnosis. Esophagoscopy should be done routinely in all clinically suspicious cases without positive roentgen findings.

Spasm in the esophagus or at the cardia should be regarded as suggestive of carcinoma until the contrary is proved.

Even esophagoscopy is not infallible, as a small tumor can be easily overlooked. Leukoplakia, reported by the pathologist from the specimen obtained by biopsy, should always direct suspicion toward malignancy. As carcinoma of the esophagus has a tendency to spread submucosally, a submucous infiltrative process can produce considerable narrowing, while the mucosa still appears intact.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

The Roentgen Diagnosis of Peptic Ulcer of the Esophagus. Umberto Cocchi. *Radiol. clin.* 22: 253-257, July 1953. (In German)

Peptic ulcer of the esophagus is seldom diagnosed by means of x-rays but generally at autopsy or by the help of the esophagoscope. It occurs in all age groups but mainly among patients between forty and fifty years. The ulcer is usually located close to the cardia but may be higher up in the distal third of the esophagus. A considerable number of cases are associated with hiatus hernia or congenital short esophagus.

The radiographic visualization of an ulcer niche in the esophagus usually is extremely difficult. Frequently the ulcer is accompanied by esophageal dilata-

tion which often is the only x-ray sign. This dilatation may be a sequel to a former spasm or stricture. Esophagitis and gastric and duodenal ulcers are sometimes found associated with an esophageal ulcer. Diverticulum and neoplasm of the esophagus enter into the differential diagnosis.

The author reports a case in a 60-year-old white male who complained of vomiting and difficulty in swallowing beginning in 1943. X-ray examination in 1944 revealed esophagitis, cardiospasm, and esophageal dilatation. Because of a suspicion of cancer below the cardia, a laparotomy was performed, but this failed to show any evidence of an infiltrative lesion. As the patient's complaints increased and his general condition became worse, Heller's operation for cardiospasm was performed in 1946, leading to a considerable improvement.

X-ray examination in 1952 again revealed esophageal dilatation with esophagitis and cardiospasm and, for the first time, demonstrated an ulcer niche at the cardia.

The author is of the opinion that the ulcer was probably caused by the continual vomiting of acid gastric contents, finally leading to maceration of the esophageal mucosa, which had already been altered by the previous operation.

Two roentgenograms.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

Clinical Significance of Pharmacoradiography, Particularly of Morphine, in Diseases of the Stomach and Duodenum. H. U. Stössel. Schweiz. med. Wchnschr. 83: 657-660, July 11, 1953. (In German)

Numerous tricks and devices have been developed by radiologists to further diagnosis of gastric and duodenal disease. Unfortunately procedures beyond the usual single-swallow, full-stomach, and gas-contrast studies are apt to be either time-consuming or not available to the average physician. In pharmacoradiography the roentgen study is made while the patient is under the influence of a function-altering drug. For the differentiation of false from truly rigid areas in the stomach wall, morphine is recommended.

The effect of morphine is to increase the stomach tone and to enhance the speed and amplitude of the peristaltic waves. Fluoroscopically one can see the stomach decrease in size, resulting in more definitive visualization, particularly of the antrum. Peristalsis is readily seen, even in the fundus and along the entire greater curvature. By the same token that a rigid segment will stand out prominently, a normal segment that gave the appearance of immobility will usually contract under the influence of the drug. Passive dilatation of the duodenum occurs secondary to the gastric changes. This is of help many times when the duodenum has not adequately filled in the original series. The drug-induced changes begin about ten minutes after subcutaneous injection of 0.01 gm. (1/6 grain) of morphine, lasting ten to twenty-five minutes and then rapidly subsiding.

The morphine study is performed as a repeat examination after inspection of the initial films. Indications are indistinct outlining of the stomach, inadequate peristalsis, questionable filling defects, questionable segments of gastric wall rigidity, and inexact localization of the pylorus. The procedure is of inestimable value in the borderline case. Although it is cheap, requires no special equipment, and may be utilized for

the first examination if one desires to do the mucosal studies when the stomach is emptying, it is not a substitute for precise workmanship. The morphine is most effective with the patient recumbent and relaxed; the stomach should be full.

Except for recent massive hemorrhage, the author knows of no contraindication. The well known general effects of morphine will, of course, be felt. Occasionally a patient shows no reaction at all to the drug; somewhat more rarely idiosyncrasy must be considered.

Twenty-two roentgenograms.

WM. F. WANGNER, M.D.
Royal Oak, Mich.

Roentgen Examination of the Stomach with Special Consideration of the Diagnosis of Cancer. A. Zuppinger and S. Läser. Radiol. clin. 22: 400-412, July 1953. (In German)

Two suggestions to simplify roentgen examination of the stomach are made: (1) taking the large stomach film one-half hour after the barium meal; (2) combined examination of gallbladder and stomach.

The authors stress the importance of routine testing of the pliability of the wall of the stomach. Rigidity or lack of pliability of the gastric wall is an important help in differentiating between inflammatory and neoplastic infiltration.

As palpation in the cardiac portion is not possible, other means of differentiation have to be used as, for instance, the contraction of the diaphragm. In cases of malignant infiltration, radiographs taken in inspiration and expiration show the filling defect and the deformity unchanged. Antibiotic therapy is of diagnostic value, as it produces a regression of an inflammatory infiltration in a relatively short time. Two weeks medication with Chloromycetin, for instance, resulted in a definite improvement of a benign infiltration and normal transmission of the peristaltic waves.

Because carcinoma of the stomach usually produces symptoms only in an advanced stage, the physician is consulted rather late. As a result, most cases are not diagnosed until after they are inoperable. Once the patient has sought medical advice, a high diagnostic accomplishment is attained, with 75 per cent of the cases examined roentgenologically within the first month, and more than 90 per cent of these correctly diagnosed.

The pre-invasive stage of the gastric carcinoma and the difficulty of its roentgenologic detection are also discussed.

Statistics are given on the mass surveys of certain age groups for detection of symptomless gastric cancers, showing that the number of malignant lesions detected is relatively small.

Fourteen roentgenograms; 2 drawings; 2 tables.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

Roentgen Studies of Two Cases of Primary Retothel Sarcoma of the Stomach. C. H. Grasser. Radiol. clin. 22: 265-277, July 1953. (In German)

As primary sarcomas of the stomach are rare tumors, most of the reports deal with a single case. The tumors usually start as intramural infiltrative growths and later extend exogastrically, endogastrically, or in both directions.

The more frequently found primary sarcomas of the

stomach are the round-cell and lymphosarcomas, but spindle-cell sarcomas, myosarcomas, and retothel sarcomas are also encountered. Furthermore, secondary sarcomas are also observed in the stomach, with the primary tumor often located in the nasopharynx, especially in the tonsils.

Two cases of primary retothel sarcoma of the stomach are presented. The first patient was a 66-year-old white male. Less than three weeks before submitting to examination he began to experience severe stomach pain twenty to thirty minutes after eating, lasting about forty-five minutes. In the fasting stage he was completely free of pain. X-ray examination at that time revealed marked thickening of the mucosal folds especially in the antrum, but also in the duodenal bulb and duodenum. Peristalsis was normal throughout. A diagnosis of hypertrophic gastritis and duodenitis was made.

A second x-ray examination, sixteen days after the first, revealed a completely changed picture. This time a large ulcer niche was demonstrated at the lesser curvature of the antrum. Opposite it, on the greater curvature, were thick mucosal folds and a small filling defect. Two hours after the barium meal the stomach was almost completely empty, the filling defect appeared more distinct, and there was a filiform spastic narrowing of the prepyloric portion. Diagnosis of a malignant tumor without obstruction was made and a sarcoma was suspected. Operation and pathologic examination revealed a retothel sarcoma of the stomach.

The second case was that of a 67-year-old white female with similar complaints. X-ray examination demonstrated thickening of the rugae in the prepyloric area and a few filling defects at the greater curvature. The gastric wall appeared elastic and definitely not rigid. The two-hour film gave better visualization of the filling defects. X-ray diagnosis of sarcoma was confirmed by operation and the pathologist's report was again a retothel sarcoma.

Both patients showed the following characteristics considered pathognomonic of sarcoma of the stomach: severe pain after eating, which is not found in the early stage of carcinoma, and freedom from pain in the fasting stage, which helps to rule out ulcer. The rapid growth of the tumor in the first case, in a sixteen-day interval between x-ray examinations, also favored sarcoma as against carcinoma.

The following x-ray features are regarded as characteristic: coarse, thickened rugae with normal elasticity of the gastric wall and good peristalsis; submucous filling defects with intact mucosa and absence of obstruction. A further important sign is the change of the x-ray appearance in the same patient and during the same examination, according to the stage of filling and tone of the stomach. This is quite in contrast with the rigid and unchangeable contours of the infiltration of the gastric wall by carcinoma. On the basis of these characteristics it is possible, in some cases with certainty, to make the diagnosis of sarcoma of the stomach.

Twelve roentgenograms.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

Correlation of Roentgenological Studies with Certain Clinical Symptoms in Peptic Ulcer. Franz J. Lust. *Am. J. Digest. Dis.* 20: 221-226, August 1953.

The author has sought to correlate the main complaints in duodenal ulcer and the roentgenologic find-

ings. Usually the pain is localized and tenderness can be elicited by palpation in the diseased area. Pain is a sign of activity and if the area of tenderness does not correspond to the site of the duodenum the main disease may be found elsewhere.

Sour stomach and heartburn are common complaints, believed to be associated with excess gastric secretions. Roentgenologic methods of recognizing secretions and mucus are described. Epigastric cramping is usually due to pylorospasm and this may at times be seen on the roentgenogram as an increase in the distance between the antrum and cap. The symptom of fullness is correlated with a delay in gastric emptying, which may be associated with pylorospasm or stenosis. As fibrosis of the pyloric canal develops, the stomach will become large and atonic and vomiting will develop. The last symptom discussed is constipation, which is correlated with the segmentation of the barium in the colon on a twenty-four-hour roentgenogram.

Seventeen roentgenograms.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

The Value of Radiology in Assessing the Progress of Duodenal Ulceration Under Treatment. George Simon and George du Boulay. *Proc. Roy. Soc. Med.* 46: 655-662, August 1953.

The authors studied 134 patients having symptoms consistent with duodenal ulcer at the time of the original examination. An ulcer crater was demonstrated in 63 of these; 71 showed only duodenal cap deformity but no crater which could be certainly identified. Many of these patients were re-examined after intervals ranging from a few weeks to two years during which they were treated medically.

As to the usefulness of re-examination, the following observations are made: Failure to show a crater in the presence of symptoms cannot be taken as an indication of healing because the radiological method of demonstrating craters is far from foolproof. Demonstration that a crater is getting smaller bears no known relationship to the length of period for which the crater may remain visible. Only 50 per cent of duodenal ulcer craters are discovered by the barium meal study. Duodenal ulcer craters are not uncommonly multiple. The disappearance of a niche is no proof of complete healing of the crater. In cases with a deformity but no certain evidence of a crater on the initial examination, further radiologic study does not provide the clinician with any estimate of healing.

Seven patients were re-examined after all symptoms had disappeared. The intervals between the first barium examination and the repeat examination with the patient symptom-free were six weeks, two months, three months, four months, and six months. In every case the crater was smaller but persisted although the patient had become free of symptoms. An eighth case is mentioned in which the symptoms vanished and the ulcer became larger. Despite this, there is no indication for re-examination unless the clinician will be influenced in his care of the case by the x-ray findings. It may be that the physician will be led to advise surgery to replace a medical regime. It may be that he will continue a strict medical regime rather than relax the treatment because of the freedom of the patient from symptoms. Under these circumstances re-examination of the apparently cured makes good sense. The prevention of relapses may thus be effected.

In conclusion, the authors list the indications for x-ray examination in duodenal ulcer: (1) for diagnosis; (2) when a patient with a demonstrated ulcer has become symptom-free under treatment, provided the attending physician is prepared to utilize the information (persistence of crater) as a guide to further treatment; (3) with the same reservations, in a patient with an established ulcer who has suffered a relapse; (4) when the nature of the symptoms changes.

Three tables.

D. DE F. BAUER, M.D.
Coos Bay, Ore.

CCK Treatment for the Syndrome of Vague Abdominal Distress, Symptomatic and Roentgenographic Study. Theodore M. Feinblatt and Edgar A. Ferguson, Jr. *Am. J. Digest. Dis.* 20: 242-244, August 1953.

CCK (the experimental designation of Hydergine, Sandoz Co.) is a complex formed by equal parts of dihydroergocornine, dihydroergocristine, and dihydroergokryptine. While it is generally agreed that ergot derivatives do not increase the propulsive motility of the intestine, this particular complex appeared to act as an effective modifier of the rate and degree of filling for the individual sections.

Twenty-eight patients with gastrointestinal symptoms considered to be functional were studied before and after the administration of this complex. The symptoms before therapy consisted of nausea, belching, flatulence, diarrhea, constipation, epigastric and abdominal pain. Ninety of these symptoms were found in the 28 patients. Following the administration of CCK, 46 of the symptoms were completely relieved and 20 were partially alleviated. Roentgenographic studies showed no changes in the propulsive movements of the intestine. Apparently, however, the CCK produced an increase in non-propulsive activity. The authors feel that the improved tonus of the smooth muscle and added activity help to churn the digestive contents, eliminate gases, and probably increase secretions, with resulting relief of some of the vague abdominal complaints which have been present.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

The Tannin Enema in Inflammatory Conditions of the Colon. E. Zdansky, L. Drexler, and K. Hampel. *Radiol. clin.* 22: 388-399, July 1953. (In German)

The authors discuss the use of tannin-barium enemas in inflammatory conditions of the large intestine. The method produces roentgenograms with markedly improved detail, due to better adherence of the contrast medium to the wall of the colon and to the stimulating action of the tannic acid on the muscularis mucosae and muscularis propria. Such stimulation causes an almost complete and even evacuation, with demonstration of a fine and regular mucosal relief under normal conditions. This pattern shows characteristic changes if the contractibility of the muscularis mucosae has been disturbed by edema or inflammatory infiltration, or if the mucosa is covered with fibropurulent membranes or destroyed by ulcers.

In chronic severe colitis, the inflammatory process penetrates deeply into the wall of the colon, impairing its contractibility. This leads to the well known tubular and rigid appearance of the colon, often accompanied by shortening of the diseased intestinal section. In severe cases of colitis the tannin enema may be

combined with subsequent air insufflation as commonly used in the double contrast method.

Eight roentgenograms.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

Appendiceal Stones Simulating Ureteral Calculi. Thomas M. Sawyers and David D. Rosenfeld. *California Med.* 79: 112-113, August 1953.

The authors report a case in which two non-laminated calculi, 4 mm. and 6 mm. in diameter, were demonstrated in the course of the right distal ureter. The symptoms were those of ureteral colic, but excretory urography showed the calculi to be outside the ureter. At operation they were found to be in the appendix.

One roentgenogram. JOHN J. CRAVEN, M.D.
Cleveland Clinic

A New Contrast Medium for Cholecystography. W. Frommhold. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 79: 283-291, September 1953. (In German)

With the introduction of Priodax (in Germany called Biliselectan) for the visualization of the gallbladder, in 1940, the previously used tetraiodophenolphthalein preparations soon became obsolete. Failure to demonstrate the gallbladder after administration of Priodax is in more than 90 per cent of the cases due to definite gallbladder pathology, but in some cases of non-visualization the contrast medium is seen within the intestine, indicating poor resorption and leaving a doubt as to whether the failure of visualization is not due to that cause rather than to actual gallbladder disease. Therefore, the research for a new intravenous contrast medium which would obviate the passage through the bowel has never been abandoned.

In 1953 the Schering Corporation in Germany (no longer connected with the Schering Corporation in America) produced a new intravenous gallbladder medium which they call Biligrafin, a dinatrium salt of the adipine acid di-(3-carboxy-2,4,6-triiodanilid). The iodine content is 64.3 per cent. The results obtained with this preparation have been so favorable that, according to the author, there is no doubt about its superiority over all previous gallbladder media. Passage through the liver is so rapid and the concentration so intense that a few minutes after the injection the large bile ducts can be plainly demonstrated on x-ray films. In favorable cases the entire system of biliary ducts within the liver can be shown. The maximal concentration of the medium in the bile of the liver occurs ten minutes after injection. In the gallbladder itself further concentration occurs, due to resorption of water, the optimum being attained in about two hours.

The technical procedure is as follows: If the system of bile ducts is to be demonstrated, a larger amount of the medium is used (30 to 40 c.c.) and films are taken fifteen minutes after the injection. For the routine visualization of the gallbladder, 20 c.c. is enough and films are taken two hours after the injection. Following a fatty meal another film is obtained.

Since iodine is very tightly bound within the molecule of the preparation, there is practically no liberation of iodine within the organism. After passage through the liver, the Biligrafin is eliminated in the feces. Normally only 10 per cent is excreted through the kidneys. This latter amount may be increased, however, if the liver and biliary system are diseased,

and such elimination may constitute a test of liver function. This is in contradistinction to Priodax, of which more than 80 per cent is eliminated through the kidneys. Biligrafin is not reabsorbed into the systemic circulation from the intestine.

The toxicity of Biligrafin is minimal: while with other media the 50 per cent lethal dose for rats is approximately 0.39 gm. per kilogram of body weight, that for Biligrafin begins at 3.4 gm. per kilogram of body weight.

The side-effects are slight. There may be mild nausea, but vomiting is rare. Among 800 patients receiving Biligrafin, vomiting was observed only once, in a nervous, mentally unstable individual. Diarrhea and other intestinal tract reactions were not observed. If injection is done very slowly over a period of about four to five minutes, no immediate reaction is noticed. With rapid injection, flushing of the face may occur.

The percentage of positive cholecystograms is increased with Biligrafin as compared with Priodax. In some cases in which Priodax failed to demonstrate the gallbladder, visualization was obtained with Biligrafin.

The intravenous method of cholecystography has great advantages: difficulties in swallowing tablets, etc., are entirely obviated, the time of the examination is markedly shortened, and examination of the gallbladder may be immediately followed by examination of the stomach.

[According to information obtained by the abstractor, this new medium is now being clinically tested in the United States by the firm of E. R. Squibb & Sons and will probably soon become commercially available.]

Six roentgenograms; 5 drawings.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Intravenous Cholangiography. Th. Hornykiewytch and H. St. Stender. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 79: 292-309, September 1953. (In German)

With the conventional gallbladder media (oral as well as intravenous) visualization of the bile ducts is possible only if a well functioning gallbladder under the stimulus of a fatty meal is emptying the concentrated bile into the ducts. If the gallbladder is not functioning properly, the bile ducts ordinarily cannot be demonstrated. The search for a new contrast material which would demonstrate the bile ducts under pathological conditions finally produced a preparation called S.H. 216, a slightly modified Biligrafin (see preceding abstract). The preparation, which contains 64.32 per cent iodine, is a 20 per cent solution of N-adipin-di-(3-amino-2,4,6-tri-iodine-phenyl-carbonic acid sodium).

Elimination of this new medium with the bile, through the liver, occurs very rapidly and in such high concentration that ten to fifteen minutes after the injection a satisfactory shadow is produced within the hepatic and common ducts. Within twenty-five minutes the bile passages are well demonstrated even in the presence of disease, the only exception being in severe liver damage. Within sixty minutes after the injection, the gallbladder begins to fill, and within one hundred and twenty to one hundred and fifty minutes the filling is optimal. Serial roentgenograms seem to show that the filling of the gallbladder is produced by an overflow of the medium from the tightly filled common duct through the cystic duct. The medium proceeds in a bell-like shape along the inner walls of the gallbladder downward until it has reached the fundus.

The technical procedure is very simple. On the day prior to the examination the patient is tested for sensitivity by injection of 1.0 c.c. of the medium. A cleansing enema is given prior to the examination. For the average patient 20 c.c. is injected intravenously. For very obese patients, up to 40 c.c. may be used. The first film is taken twenty to twenty-five minutes after the injection, with the patient prone on the table and the right side of the body elevated by sand bags about thirty degrees. This position is necessary to project the common duct away from the spine. The second film is taken sixty minutes after the injection, the third film one hundred and twenty to one hundred and thirty minutes, and the fourth and last after the fatty meal.

Two hundred and seventy-four patients were subjected to the examination. Slight or moderate disturbances occurred in 6 per cent of this series. Rather severe complications, with symptoms lasting several hours or days, were observed in 1 per cent. The slight symptoms consisted of restlessness, a sensation of heat, pressure in the upper abdomen, vomiting, perspiration, and dizziness. The severe complications were fever continuing as long as four days, collapse lasting up to thirty minutes, chills, and a definite deterioration of inflammatory processes in the liver and in the bile ducts.

The following observations were made in a normal cholangiocholecystogram. The intrahepatic and extrahepatic bile ducts become demonstrable in ten to fifteen minutes, showing their best filling twenty minutes after the injection. The width of the normal common duct depends upon the stage of its contraction. During the emptying phase, it may be 1 to 2 mm. wide; during the filling phase it may measure 4 to 5 mm. A width more than 5 mm. is considered to be pathological. The best contrast shadow of the gallbladder is obtained one hundred and twenty to one hundred and fifty minutes after injection. During the filling phase of the common duct, the sphincter of Oddi begins to open and some bile is emptied into the duodenum. By the time the gallbladder is well filled the ducts are only faintly demonstrable. Twelve to twenty-four hours after the injection the entire amount of the contrast material is usually in the colon.

In the presence of gallstones, the filling of the gallbladder is usually delayed. The filling of the bile ducts is also delayed for the most part, which may be due to hypertonus or spasm of the sphincter of Oddi. In some cases, however, an early emptying of the bile duct into the duodenum was observed, which was interpreted as being due to hypermotility of the biliary system. Often the hepatic and the common ducts are dilated. Frequently the gallbladder was visualized with the new medium though there had been non-visualization with Priodax given by mouth. This is because visualization with Priodax requires that the concentrating power of the gallbladder be intact, while for visualization with the intravenous medium this is not necessary, the bile being already radiopaque as it enters the gallbladder. Stones within the hepatic and common ducts are simply and beautifully demonstrated.

In the presence of clinically and bacteriologically proved cholecystitis without stones, three possibilities may occur. The gallbladder and the bile ducts may show a normal filling, the filling may be delayed, or there may be non-visualization of the gallbladder. Here the intravenous method may allow a differential diagnosis between a pathological gallbladder without

and one with obstruction of the cystic duct, since there will be failure to visualize the gallbladder only if the cystic duct is occluded. If it is patent, the gallbladder will probably be demonstrated even though it is diseased. If this type of pathology is suspected, it may be necessary to follow up the intravenous cholecystography with a Priodax examination to rule out gallbladder disease without stones.

Intravenous cholecystography is of the greatest importance in patients in whom the gallbladder has been removed. While formerly it was impossible to get any information about the bile ducts, it is now easy to demonstrate the duct system after cholecystectomy. The findings in such patients can be classified into four groups: (1) the bile ducts may be entirely normal and the sphincter of Oddi may function quite normally; (2) there may be marked spastic conditions within the ducts, particularly in the lower section of the common duct; (3) the ducts may be markedly widened and atonic due to hypertonicity of the sphincter of Oddi; (4) there may be a faint fleeting filling of the ducts due to insufficiency of the sphincter of Oddi.

Twenty-three roentgenograms.

WM. A. MARSHALL, M.D.
Chicago, Ill.

Intravenous Cholangiography with Biligrafin. K. Huber and H. U. Stössel. Schweiz. med. Wchnschr. 84: 117-118, Jan. 16, 1954. (In German)

The authors discuss intravenous cholangiography with Biligrafin, a sodium salt containing 64.3 per cent iodine (see two preceding abstracts).

The great advantages of the intravenous method as compared with the older method of gallbladder examination are as follows: (1) Difficulties in absorption are avoided. (2) The intravenous method can be used in cholecystomized patients. (3) The intravenous method demonstrates the bile ducts. These advantages are illustrated by 14 roentgenograms, including: an excretory urogram in a patient with obstructive jaundice from cholangitis; complete visualization of the common duct down to the papilla in a normal person; normal hepatic and common ducts in a patient with numerous gallstones; dilated biliary ducts from obstruction incident to tumor in the head of the pancreas; normal biliary ducts but a cystic dilatation of the stump in a cholecystomized patient; normal bile ducts, but stone in gallbladder, in a patient who had no filling at all with the usual oral study; an ampullary widening in the mid-segment of the choledochus from an obstruction seen in its center (stone? scar?) in a cholecystomized patient; many large stones in the common duct, with enormous widening of the common and intrahepatic ducts in a cholecystomized patient.

CHRISTIAN V. CIMMINO, M.D.
Fredericksburg, Va.

Telepaque and Pseudoalbuminuria. E. E. Seedorf, W. N. Powell, R. G. Greenlee, and D. N. Dysart. J.A.M.A. 152: 1332-1333, Aug. 1, 1953.

Because of the occurrence of pseudoalbuminuria after the use of Priodax and Monophen (see Radiology 55: 740, 1950; 59: 422, 1952), a study of a third medium, Telepaque, was undertaken to determine whether the small amount of this drug eliminated through the kidneys was sufficient to cause a similar effect. As in the studies on the other media, Exton's

reagent, Heller's ring test, Roberts' reagent, and nitric acid and heat were used in examination of the urine.

One hundred patients whose preliminary urinalyses showed no albuminuria were given 2.0 gm. of Telepaque and a repeat urinalysis was done following cholecystography.

The incidence of false positives was approximately the same as with Priodax and Monophen when Exton's reagent (hot) was used and also with the nitric acid and heat test. The use of Exton's reagent (cold) and Roberts' reagent showed fewer false positives with Telepaque than did the other gallbladder media.

Since Telepaque is eliminated primarily by the gastrointestinal tract, an increased incidence of diarrhea and a decrease in dysuria were expected. The results did not support this assumption.

An undesirable effect of Telepaque was a residual deposit in the large bowel causing occasional interference with interpretation of gallbladder or renal calculi.

Two tables. M. HARLAN JOHNSTON, M.D.
Jacksonville, Fla.

THE MUSCULOSKELETAL SYSTEM

Ankylosing Spondylitis. F. Dudley Hart. Schweiz. med. Wchnschr. 83: 786-788, Aug. 22, 1953. (In English)

The author presents the subject of ankylosing spondylitis from the British point of view in this issue of the Swiss Medical Weekly, which is dedicated to the Eighth International Congress for Rheumatoid Diseases, held in Geneva, Aug. 24-28, 1953. He feels that ankylosing spondylitis, which he considers identical with Bechterew's disease and Marie-Strümpell disease, is quite distinct from rheumatoid arthritis. Of interest is the frequent association with (1) iridocyclitis (6-10 per cent, which is three to four times as often as in rheumatoid arthritis); (2) duodenal ulcer (no incidence stated); and (3) pulmonary tuberculosis (7 per cent). As to treatment, he condemns immobilization except for the prevention of deformities, advises exercise and deep x-ray therapy, and uses Cortisone and Corticotropine only in order to suppress acute attacks.

GERHART S. SCHWARZ, M.D.
New York, N. Y.

Spondylosis Hyperostotica. V. R. Ott. Schweiz. med. Wchnschr. 83: 790-799, Aug. 22, 1953. (In German)

The author insists on a strict division between Marie-Strümpell's spondylitis, which is said to be a rheumatoid condition, and Bechterew's disease, which is a neurogenic affection, as shown pathologically by Bechterew himself. This report concerns 11 male and 4 female patients afflicted with an ankylosing condition of the spine which is believed to be a third entity, for which the name "spondylosis hyperostotica" is proposed. The author believes that it may be identical with the "sugar-glazed spine" described by Wenzel in 1824 and by Rokitsky in 1856, *hyperostose moniliforme du flanc droit de la colonne dorsale* described by Meyer and Forster in 1938, and *hyperostose ankylosante vertébrale sénile* mentioned by Forestier and Rotes-Querol in 1950.

The age of the patients averaged 62.2 years, ranging from forty-four to seventy-two. Because of its insidious onset, the duration of the disease could not be judged, but most patients, when first seen, had suffered from the condition for decades. Precursors were

acute lumbago in 2 cases and torticollis in 4. A history of trauma, infection, or exposure to cold was extremely rare, and these factors were excluded as possible causes.

The roentgen findings included: mild osteoporosis, kyphosis due to wedging of T7-10, sclerosis of the end plates of the vertebral bodies, particularly C5-7 and T8-12, marginal ridging with prevertebral osteophytic bridging. In the lateral view osteophyte formation assumed a "frozen sugar coating," "candle drippings," or "frozen cascade" appearance. Intervertebral spaces were sometimes narrowed, sometimes well preserved. The annulus fibrosus was not ossified. The small intervertebral articulations, the costovertebral joints, and the lumbosacral joints were normal. The differential diagnosis included, in addition to the conditions mentioned above, melorheostosis, fluorosis, and hyperostosis associated with pachyderma.

Fourteen illustrations, including 12 roentgenograms [which suggest nothing more than common osteoarthritis to the abstracter]. GERHART S. SCHWARZ, M.D.
New York, N. Y.

Peculiar Structural Changes in the Epiphyseal and Metaphyseal Regions in Osteogenesis Imperfecta Tarda. G. Liess. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 79: 216-223, August 1953. (In German)

The author reports two cases of osteogenesis imperfecta tarda (osteopsathyrosis) in which peculiar structural changes, most marked about the knee, strongly suggested enchondroma. These consisted of multiple large and small cyst-like areas, separated by coarse trabeculae. The involved area extended throughout the spongy and compact bone, obliterating the epiphyseal line, but did not affect the joint surface. The ends of the bones were considerably expanded. Similar changes, though of lesser degree, were observed in the tibia.

The appearance in other areas was less striking. The pelvis showed extensive rarefaction, especially in the central portion, with a fine zone of compact bone about the borders. The femoral heads, including the epiphyses, were enlarged and rarefied, and numerous cystic areas were present, with thinning of the cortex. Bone shafts manifested the usual type of change, with cortical thinning, curvature, fractures, and callus formation. Hands and feet showed marked atrophy, with a web-like pattern of the trabeculae. Generally the changes were greater in the lower extremities than in the upper. The skull showed thinning of the calvarium and numerous wormian bones, especially in the lambdoidal suture. In the spine contrast was poor; there was flattening with bi-concave disks in the lumbar region but no disk destruction.

The author feels that the changes described were brought about by osteopsathyrosis and not necessarily by associated enchondroma. In searching the literature he found very few similar cases. In one of his patients associated rickets may have played a part.

Three roentgenograms; 1 photomicrograph.

E. W. SPACKMAN, M.D.
Fort Worth, Texas

Serial Radiographic Observations During the Early Stage of Acquired Syphilis with Follow-up X-ray Films. A. Beutel. *Radiol. clin.* 22: 228-236, July 1953. (In German)

Though bone changes in congenital syphilis and the later stages of acquired syphilis are well known, re-

ports on bone involvement in the early stage of the disease are rather scarce.

The author's patient was a 22-year-old white woman, who complained of some swelling of the forehead associated with continuous headaches. Her family physician treated her for frontal sinusitis, but similar swellings appeared over the left parietal bone and the left sternoclavicular joint. Two weeks later a macular exanthema developed and the Wassermann reaction was strongly positive. The venereal infection apparently had occurred eight weeks earlier. Radiographic examination revealed an area of increased radiolucency, about 0.5 cm. in diameter, in the right frontal bone. Despite immediate antisyphilitic treatment, a film obtained one month later showed that this lesion had increased in size, with some sequestration in its center. A few months after this, the pathological changes had completely regressed and the roentgenologic picture was normal.

Similar cases, reported in the literature, are discussed. Their common aspect was an increase in the bone lesions in the skull during the first month of antisyphilitic treatment followed by their complete disappearance. The soft-tissue swelling generally regressed promptly with the institution of treatment. This apparent discrepancy between bone and soft-tissue manifestations is explained by the fact that during the first few weeks of the treatment the syphilitic granulation tissue in the bone is destroyed, leading to a larger appearing bone defect. Increase of pain at night was usually noted. The radiolucent area may be mistaken for a metastatic or non-specific osteomyelitic lesion.

Eight roentgenograms.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

Comparative Study of the Reaction to Injury. II. Hypervitaminosis D in the Frog with Special Reference to the Lime Sacs. Hans G. Schlumberger and Donald H. Burk. *Arch. Path.* 56: 103-124, August 1953.

The injurious effect of hypervitaminosis D has been studied chiefly in man, rats, guinea-pigs, dogs, and chickens. In these animals, as in nearly all vertebrates, the normal calcium depot is found in bone trabeculae, especially in the long bones.

The authors have utilized the frog (*Rana pipiens*) for further study, since in this animal the calcium depot problem is further complicated by the presence of a variable store of calcium in the paravertebral lime sacs. These multiloculated structures are lined by epithelium, which probably secretes calcium into their interior, where it is precipitated as microscopic crystals of the mineral aragonite (calcium carbonate). This is unique among the vertebrates. Although in the invertebrates calcium occurs almost solely as a carbonate, in the vertebrates 85 to 90 per cent of the calcium in bones and in pathologic soft tissues is in the form of the phosphate.

Experimentally induced hypervitaminosis D caused extensive osteoporosis in the frog. At times, in the later phases of the experiments, focal destruction of cortex was observed roentgenographically. This occurred most markedly in the metaphyses of the long bones: femur, tibia, and/or fibula. The osteoporosis occurs even with the administration of supplemental calcium, and it is felt that this may be due to the relative phosphorus deficiency, the normal deposition in bone occurring as calcium phosphate. In hypervitaminosis

D this deposition ceases, yet there is continued filling of the lime sacs in the form of calcium carbonate.

The authors found that large doses of vitamin D had very little, if any, demonstrable effect on the rate of healing of fractured bone.

In hypervitaminosis D in the frog, it is unusual for tissues other than the kidneys to be involved in metastatic calcification. Nephrocalcinosis occurred when 100,000 units or more of vitamin D were administered without supplemental calcium. This was intensified with added calcium. The calcium was largely in the lumen of the tubules; seldom in the epithelial cells. While it was present in all sections of the nephron, it occurred most abundantly in the proximal convoluted tubules as calcium phosphate.

The authors found that the South African clawed toad, *Xenopus laevis*, responded to hypervitaminosis D with osteoporosis and metastatic calcification, similar in character and degree to that observed in *Rana pipiens*. However, the former does not store calcium in the same manner, having no paravertebral lime sacs. *Rana pipiens* treated with large doses of vitamin D maintained a fairly constant serum calcium level by apparently excreting the excess into the paravertebral lime sacs. The sacless *Xenopus laevis*, on the other hand, showed a significant rise in serum calcium with hypervitaminosis D, suggesting that the lime sacs may function as a protective reservoir, aiding in maintaining a normal serum calcium.

Under the effect of hypervitaminosis D neither the parathyroids nor the cellular components showed any clear-cut morphological change.

Eleven roentgenograms; 3 photographs; 12 photomicrographs; 7 tables. RICHARD E. OTTOMAN, M.D.
Los Angeles, Calif.

Discography in the Diagnosis of Herniation of the Lower Lumbar Intervertebral Discs. John J. Davies and E. Converse Peirce, II. Illinois M. J. 104: 118-125, August 1953.

The authors' technic for diskography is as follows: A 2-inch 21-gauge needle, as a guide, is inserted to but not into the dural sac. This is done after premedication with 15 mg. of morphine, with the patient in the lateral spinal position with the back flexed. Guide needles are inserted at all three of the lower lumbar interspaces. Thereupon a lateral view is obtained. If the tip of any of the three needles is not pointed squarely to the corresponding disk space, necessary modifications in direction are made, frequently without further check films. The authors have not found fluoroscopic visualization satisfactory for positioning of the needles. Transdural, 26-gauge needles are inserted through the guide needles, penetrating the posterior longitudinal ligament overlying the disk and the disk itself for about 1/2 inch. A final check film is taken. If this is satisfactory, 70 per cent Diodrast is injected into each disk. Injection of a ruptured disk causes pain, and for this reason the one most likely to be ruptured is injected last. Another lateral film is taken to show if all interspaces are properly injected. The needles are then withdrawn and anteroposterior, oblique, and other films are taken as desired. The patient may require medication for pain up to twenty-four hours afterward.

For diagnosis of a ruptured disk, injection should reproduce the symptoms of nerve root pressure, and the lateral film should show a posterior extension of the medium beyond the normal disk space.

Non-symptomatic ruptures are found. These show the disk protruding laterally or anteriorly or into a Schmorl's node. No evidence has been found of leakage of Diodrast through the needle puncture, or of nuclear leak through the puncture, even with needles up to 20-gauge.

For verification and localization of disk lesions, diskography is superior to myelography as a direct rather than an indirect method. The necessity for removal of the opaque medium is obviated. Nerve root irritation from residual opaque material is avoided.

The authors report their results in 23 cases in which diskography was attempted. Thirty ruptured disks were found in 20 patients. Illustrative cases are reported.

Ten roentgenograms. D. DE F. BAUER, M.D.
Coos Bay, Ore.

Aseptic Necrosis of the Capitulum Humeri. C. Buetti. Radiol. clin. 22: 241-246, July 1953. (In German)

The author reports on two typical cases of aseptic necrosis of the capitulum humeri, or capitellum, observations on which are scanty in the literature. This disease is easily overlooked in the early stages and is often misinterpreted in later stages. It was first described by Panter of Denmark (Acta radiol. 8: 617, 1927) and is therefore sometimes called Panter's disease. It occurs in boys of five to twelve years and is rarely seen in girls.

The x-ray signs are pathognomonic. In the early stage there is a subcortical rarefaction of the bone structure of the capitulum. Weeks or even months later, radiolucent areas alternating with zones of sclerosis are observed, leading to a more or less marked fragmentation of the epiphysis.

Treatment consists in immobilization of the elbow joint. Despite the sometimes extensive changes, as demonstrated radiographically, there is always a return to normal.

Nine roentgenograms.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

Occurrence of Bipartite Os Radiale Dorsale. Previously Unreported Accessory Bones of the Radiocarpal Joint. A. Rösli. Radiol. clin. 22: 361-365, July 1953. (In German)

Supernumerary bones of the radiocarpal joint occurring bilaterally were observed in a 72-year-old white female referred for x-ray examination because of an injury to the wrist.

As the accessory bones were identical in both wrists, the possibility of a fracture could be ruled out. The author believes that not sufficient attention has been paid to these sesamoids or accessory bones, which are often misinterpreted.

Nine roentgenograms.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

GYNECOLOGY AND OBSTETRICS

Intrauterine Roentgenography as an Aid in Determining Fetal Age. A Preliminary Report. Theodore W. Adams, James M. Whitely, and Max H. Parrott. West. J. Surg. 61: 448-452, August 1953.

A study of 180 premature single births showed that

the fetal mortality from prematurity drops significantly at about the thirty-fourth week. It would seem, therefore, that when some condition exists which makes premature interruption of pregnancy advantageous, as maternal diabetes, the danger of fetal death from prematurity would be greatly reduced if the pregnancy could be carried to about the thirty-fifth week.

In the individual case, estimation of the duration of pregnancy from the date of last menstruation, quickening, abdominal palpation, mensuration, and existing x-ray studies is notoriously inaccurate. Hodges' chart of fetal ossification demonstrates that the distal femoral epiphysis appears about the thirty-fifth week, and this was therefore chosen as a criterion of the duration of gestation. The authors obtained the best percentage of visualization in the lateral position, with the following technical factors: 200 ma., 75 kv.p., 1/2 second, large focal point, 40-inch distance, Bucky diaphragm. The first film was obtained in what was believed to be the thirty-second week of gestation, with subsequent films at weekly intervals until the ossification center could be demonstrated. Pregnancy was terminated a few days thereafter.

In 11 of 15 patients with diabetes, the fetal distal femoral epiphysis appeared by the estimated thirty-seventh week and in none of these cases did any baby die of prematurity after the pregnancy was terminated. Of 3 babies delivered before the appearance of the epiphysis, at the estimated thirty-eighth week, 2 died. In at least 1, and probably in both, prematurity was the cause of death. In 1 case the film was negative at the estimated thirty-third week. Subsequent spontaneous delivery ensued, and the child, weighing 4 pounds 8 ounces, survived.

The authors feel that roentgenologic demonstration of the distal femoral epiphysis is an additional, and possibly individually more accurate, method of determining when premature birth may be undertaken with a comparatively good outlook for fetal survival. They estimate that even if six films are necessary, one a week for six weeks, the fetus is exposed to less radiation than during the average Caldwell-Moloy procedure.

One chart.

R. F. LEWIS, M.D.
Cleveland Clinic

Placentography. Symposium. I. Opening Address, A Review of Placentography. J. Chassar Moir. **II. Direct Placentography.** Maria E. Grossmann. **III. Localisation of the Placenta by Means of Arteriography and Auscultation.** Olof Norman. **IV. The Diagnosis of Placenta Praevia by Soft Tissue Radiography.** A. S. Whitehead. **V. The Radiological Localisation of the Placenta.** F. Reid. *Brit. J. Radiol.* 26: 385-412, August 1953.

In opening this Symposium on placentography, Moir reports that placenta praevia is responsible for about 5 per cent of maternal deaths. Many patients, however, can be saved if the condition is recognized early and adequately treated. Roentgenography—demonstration of displacement of the fetal head, amniography, soft-tissue technics, and special procedures described later in the Symposium—have added much to the accuracy of diagnosis. Displacement of the head is not regarded as a very reliable sign, as it may also be caused by a tumor. Amniography has the disadvantage that it may cause premature labor. The soft-tissue technic, in spite of some pitfalls, is at present the most useful. Grossmann reports animal experiments with contrast

media selectively absorbed by the placenta. Thorotrast proved successful in the guinea-pig. "Angiopac," an iodine emulsion used for angiography, was useful in the mouse and guinea-pig, and not in the rabbit or rat.

Arteriography and auscultation as a means of localizing the placenta are described by Norman. Arteriographic studies were made in 15 cases of clinically suspected placenta praevia. A retrograde injection of Umbradil (42 per cent instead of 70) into the femoral artery gave satisfactory visualization of the placenta and caused no premature labor or evidence of fetal irritation. The placental sinuses are best seen about four seconds after completion of the injection.

The occurrence of a soft souffle over the pregnant uterus has long been known. Comparison of the sounds with angiographic observations shows that they arise in the dilated uterine vessels supplying the placenta. From a study of a small series of patients, it appears that, if the souffle is stronger on one side than the other, the placenta is probably on that side; if the souffle continues without interruption across the mid-line, the placenta is probably on the opposite side; if the sounds are heard far out in the flank, the location is posterior; if they are audible over the anterior border of the uterus, the placenta is anterior or high up in the fundus.

Whitehead reports the findings in 525 pregnancies in which a soft-tissue technic was used, with a wedge filter, for anteroposterior and lateral recumbent views and, if desired, oblique projections. His technic has been described in fuller detail elsewhere (*J. Fac. Radiologists* 4: 245, 1953. *Abst. in Radiology* 62: 301, 1954). The placenta was located in every instance. Placenta praevia was diagnosed in 70 cases and confirmed clinically in 61. The head presented in 44 instances and the breech in 3, while transverse and oblique presentation occurred in 23.

Reid localizes the placenta by means of anteroposterior and lateral radiographs with the patient so placed that the fetus itself serves as a contrast medium. The examination is made with the patient erect. If the presenting part is shown to be lying centrally and within 2 cm. of both pubis and promontory, placenta praevia can be excluded. If the presenting part is more than 2 cm. from the promontory, a further film is obtained in the semierect position. Causes of error are displacements due to a distended bladder or feces in the rectum or pelvic tumors. Among 518 patients examined, 44 were reported to have placenta praevia; this was confirmed in 32, doubtful in 2, and unconfirmed in 10. This series of cases has been previously reported with details as to the radiographic appearances (*Proc. Roy. Soc. Med.* 44: 703, 1951. *Abst. in Radiology* 59: 145, 1952).

Thirty-one roentgenograms; 5 photomicrographs; 1 phonogram; schematic drawings and tables.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

THE GENITOURINARY SYSTEM

Experiences with High Concentration Urokon for Pyelography. Reed M. Nesbit and Thomas E. Nesbitt. *J. Urol.* 70: 332-337, August 1953.

A series of 585 consecutive intravenous pyelographic studies made with 70 per cent Urokon are compared with a thousand in which 30 per cent Urokon was used. There was striking improvement in the quality of the

pyelograms with the more concentrated solution. In one-third of the cases, the density was considered equal to that of a retrograde study. Mildly annoying side reactions in 55 per cent of the cases were not significantly different from those encountered with other media, except for the 30 per cent Urokon, for which the incidence was significantly lower (18 per cent). This feature, however, is felt to be greatly overbalanced by the outstanding advantages inherent in the more highly concentrated solution. The authors now use 25 c.c. of 70 per cent Urokon, injected over a one-minute period. Slower rates, up to five minutes, have been employed without evident advantage.

The properties of 70 per cent Urokon which allow its excretion at the high concentration levels obtained are not readily explained, though several postulates are suggested. The authors mention the diminished protein-binding capacity of Urokon, allowing for increased diffusibility, as well as the importance of glomerular filtration, since the blood level is so much above the maximum tubular excretion.

Concentrated Urokon has also been found useful in angiography. Injection for translumbar aortography can be accomplished under local rather than general anesthesia, since it is so free of untoward reaction. Electrocardiographic changes suggesting myocardial ischemia and coronary insufficiency have been reported following rapid injection of 75 per cent Neo-iopax and 70 per cent Diodrast for angiocardiology; however, tracings of 10 patients who received 50 c.c. of 70 per cent Urokon failed to show such changes.

Seven roentgenograms; 2 tables.

C. M. GREENWALD, M.D.
Cleveland Clinic

Clinical Experiences with a New Medium (70 Per Cent Urokon-Sodium) in Intravenous Urography. John E. Byrne and William F. Melick. *Missouri Med.* 50: 599-603, August 1953.

In an effort to reduce the number of unsatisfactory intravenous urograms, the authors have investigated the use of 70 per cent Urokon in 500 patients. One-half of the patients received the antihistamine Benadryl prior to examination—50 mg. three times on the preceding day and 100 mg. one hour before injection, except for those with a specific allergic history, for whom the dosage was doubled. Antihistamines have been shown to modify the hypersensitivity response to an organic iodine compound administered intravenously, to reduce apprehension, and to decrease ureteral spasm.

A test dose of 1.0 c.c. of 70 per cent Urokon is administered intravenously and the patient is observed for two minutes. If there is no untoward reaction, the remainder of the 25 c.c. ampule is injected in less than thirty seconds. The feeling of warmth and visible flush are considered a physiologic response to the drug and not as reactions.

The radiographic exposures following the injection are largely an individual problem. Each film is viewed wet, and the taking of subsequent films is based on the previous one rather than regular time intervals. Cystograms may be obtained routinely if desired. Failure of excretion in one hour should not complete the examination, as a surprising number of malfunctioning kidneys may excrete at two or eight hours.

Results of the 500 cases are tabulated as to (1) individual response to the contrast medium and (2) quality of the pyelograms.

Reactions were graded as follows: Grade I: transient nausea (without vomiting) and arm pain; Grade II: nausea and vomiting, urticaria, lacrimation, and cough without respiratory distress; Grade III: pronounced respiratory distress, persistent coughing, dyspnea and cyanosis; vasomotor response with an alteration in pulse or blood pressure.

The use of Benadryl reduced the incidence of urticaria and lacrimation but did not significantly alter the other reactions. The single severe reaction of respiratory distress and cyanosis occurred following the injection of the test dose. The patient recovered after treatment with adrenalin and oxygen.

Seventy-seven per cent of the pyelograms were rated as good, 9 per cent as fair, and 14 per cent as poor.

Nine roentgenograms; 4 photographs; 3 tables.

M. HARLAN JOHNSTON, M.D.
Jacksonville, Fla.

Functional Roentgenology of the Urinary Tract. R. Seyss. *Fortschr. a. d. Geb. d. Röntgenstrahlen* 79: 233-239 August 1953. (In German)

The author feels that sufficient attention has not been paid to functional disturbances in the urinary tract, in spite of occasional reports dealing with pyelocopy, kymography, and serial roentgen studies. He has sought to establish a simple and practical functional test which can be used routinely. He avoids the retrograde method whenever possible, considering it unphysiological, and claims that serial films with the intravenous method are comparable in detail and give more information. He stresses releasing compression to visualize the ureters and the making of films in various positions, especially lateral and upright.

Disse's muscle (musculus sphincter calycis) is considered not to expel the urine actively but to represent a mechanism of retardation. In the normal patient, therefore, in the upright position, the greater portion of the kidney pelvis should be empty and most of the residue visualized in the subpapillary spaces. In pathological cases contraction of the involuntary musculature is lacking and various significant appearances result. Placing the patient upright is similar in effect to an injection of Prostigmin. In those cases showing lack of contraction in the upright position, the author has administered Prostigmin and observed no further action.

Hypotonicity is manifested by sinking of the contrast material, which is heavier than the urine. This type of sedimentation indicates an atonic pelvis and lack of contractile power of the smooth muscle but indicates a good functioning parenchyma. Lack of contractile power suggests a type of dyskinesia with damage of the muscle and nervous elements similar to that seen in the gallbladder.

Early tuberculosis is indicated by lack of emptying in the upright position associated with retention in the ureters, partially due to edema and smooth muscle spasm. Similar changes may be seen in association with calculi, especially if there is inflammation. These changes appear to be independent of the actual obstruction by the stone. The author designates the changes observed in the erect position following intravenous pyelography as the "orthostatic reaction." He has found it increasingly important as observed in routine work, especially in the early stages of disease.

Eight roentgenograms. E. W. SPACKMAN, M.D.
Fort Worth, Texas

Renal Angiography. Marvin Harvard. *J. Urol.* 70: 15-19, July 1953.

The author describes the experience of the New Orleans Charity Hospital with renal angiography by translumbar aortic puncture in over one hundred patients. There have been no fatalities and only minor discomfort in most cases, even though a second aortic puncture is immediately made and the study repeated if the initial exposure is unsatisfactory. Causes of unsatisfactory angiograms, *i.e.*, poor injection technic, obesity of the patient, and mechanical failure of the apparatus, are discussed. The procedure has been helpful in the evaluation of renal function in diseased kidneys, in hypertension of unknown etiology, and in the differentiation between various lesions, notably renal tumors and cysts. It is concluded that renal angiography has a "definite though limited place in urologic diagnosis."

W. J. TUDDENHAM, M.D.
University of Pennsylvania

A Résumé of the Experience in the Making of 1,500 Renal Angiograms. Parke G. Smith. *J. Urol.* 70: 328-331, August 1953.

The author has completed 1,500 renal angiograms and he briefly re-evaluates certain aspects of this procedure in the light of his experience. It is suggested that the term translumbar arteriography be reserved for the actual procedure, as its field of application can be increased, with only minor variations in technic, to produce a splenic or hepatic rather than a renal angiogram. Use of intravenous sodium pentothal is felt to contribute greatly to the safety of the examination and to favor the routine production of high-quality angiograms. Recently 70 per cent Urokon has been used instead of 70 per cent Neo-iopax, with gratifying results. Only rarely is more than 12 c.c. of either medium given.

Anomalous branching of the renal artery and anomalous renal arteries have been found to occur much more often than previously suspected, and the importance of knowing the arterial pattern in all congenital anomalies for which renal surgery is contemplated is stressed. By means of angiography one can determine the true status of the renal parenchyma as to its reserve or salvage factor. As regards the differentiation between cyst and tumor, the author now believes it would be best to emphasize the lack of areas of puddling in cystic lesions, where avascularity is the rule. In certain tumors with rapid growth, and in the very old tumor, the central portion may have lost its vascularity, so that characteristic puddling may be found only at the periphery. The author is convinced that with increased experience in interpretation, the differentiation of cyst and tumor can be brought close to perfection.

Investigation has proved the value of angiography in cases of renal pain of unexplained cause, showing that it may be due to obstruction of the venous outlet of the kidney rather than the urinary. Attention is called to the fact that a pressor substance is produced in the congested kidney due to venous obstruction as well as in the ischemic kidney resulting from arterial compression and that hypertension may occur as the result of either of these circumstances.

The procedure of translumbar arteriography with the production of a renal angiogram carries with it dangers so slight that it may be used as a routine study, this series having been completed with no deaths, and only minimal morbidity.

C. M. GREENWALD, M.D.
Cleveland Clinic

A Simple Injector for Aortography and Intravenous Angiography. Frank Hinman, Jr. *J. Urol.* 70: 119-120, July 1953.

The author describes a device—appealing in its simplicity—for the rapid injection of contrast media in angiography. The device consists of two flat boards hinged together at one end. A hole in the upper board permits the passage from beneath of a syringe barrel as far as its flange. A depression in the lower board secures the end of the plunger. Pressure exerted on the outer end of the upper board forces the syringe barrel down on its plunger and expels the contrast medium contained in the syringe. Injection which would require eight minutes by hand can be made in three minutes by this means.

One photograph; 3 drawings.

W. J. TUDDENHAM, M.D.
University of Pennsylvania

Perirenal Insufflation with Arteriography. Frank C. Hamm and Harrison C. Harlin. *J. Urol.* 70: 318-327, August 1953.

The authors discuss their experience with over 200 cases in which perirenal insufflation and arteriography were used singly or in combination. A paracoccygeal approach for insufflation similar to that suggested by Ruiz Rivas (*Am. J. Roentgenol.* 64: 723, 1950. *Abst. in Radiology* 57: 618, 1951) is described.

As a solitary procedure perirenal insufflation is probably of greatest value in the investigation of the adrenal gland. When it is used with arteriography, it immediately precedes that examination, being done under intravenous anesthesia. Arteriography is considered most useful in the differentiation of solitary renal cysts and tumors. The usual striking differences in vascular pattern seen in these two types of lesion are reviewed. The authors, however, still subject all cysts to surgery, as occasionally a parenchymal tumor is found in the cyst wall. Also certain tumors, such as fibrosarcoma, do not give the typical arteriographic tumor pattern but rather resemble cysts.

Further uses of arteriography mentioned include determination of blood vessel distribution prior to heminephrectomy and in the presence of congenital abnormalities, as a guide to renal function, based on the degree of impairment of renal blood supply, in the diagnosis of extrarenal and retroperitoneal tumors, and in the demonstration of aberrant vessels, aneurysm, arteriovenous fistula, and obstruction from embolism or thrombosis. The only contraindications are severe debilitation, uremia, cardiac failure, severe allergy, and sensitivity to the contrast medium.

Recently, in selected cases, retrograde urography has been performed along with insufflation and arteriography as one examination, the average total time required being under thirty minutes.

Twenty-one roentgenograms; 1 drawing.

C. M. GREENWALD, M.D.
Cleveland Clinic

Presacral Oxygen Injection. Fred Lerman, James G. M. Harper, Arthur D. Hertzberg, Michael H. Berman, and Philip H. Lerman. *J. Urol.* 70: 312-317, August 1953.

The authors describe and discuss the technic of visualization of the retroperitoneal space originally proposed by M. Ruiz Rivas (*Am. J. Roentgenol.* 64: 723, 1950. *Abst. in Radiology* 57: 618, 1951) and report 5

illustrative cases. More than 200 injections have been performed without oxygen embolus or other serious complications.

Six roentgenograms; 1 drawing.

C. M. GREENWALD, M.D.
Cleveland Clinic

Clinical Diagnosis of Tumors of Adult Renal Parenchyma. Edgar Burns. *J. Urol.* 70: 9-14, July 1953.

A review of statistical reports from several medical centers shows the ten-year survival rate for renal tumors to be less than 30 per cent. The characteristic triad of hematuria, pain, and mass in the side appears late in more than half the cases. Early diagnosis must depend upon such measures as excretory pyelography, cystoscopy, and bilateral retrograde pyelography, the last in prone and upright positions. Other diagnostic aids include perirenal air insufflation, exfoliative cytology (Papanicolaou), and aortography.

Aortography is perhaps the most valuable adjunct in the differential diagnosis of a space-occupying lesion. If the lesion is a cyst, there is an avascular area below an "umbrella pattern" representing the distorted vascular tree. Multiple areas of avascularity are noted in polycystic disease. In the presence of a tumor, there is a thickened nutrient artery, with an irregular pooling of contrast medium in the sinusoids. Occasionally sinusoids are also seen in the periphery of a cyst and, if pooling is present as well, the thickness of the wall may be an important differentiating sign; cysts usually have a thin wall as compared to the thickened periphery of a tumor.

Because of the poor prognosis in adult renal tumors, the author makes a plea for more routine urinary studies in patients between the ages of forty and fifty-five years. "It seems reasonable to suggest that this group be subjected to the same careful consideration of the urinary tract that is given the chest, gastrointestinal tract, and other systems."

Two drawings.

STEPHEN SEDLAK, M.D.
University of Pennsylvania

Filling Defects of Ureterogram Caused by a Varicose Ureteral Vein. Michael H. Berman and Herbert Copeland. *J. Urol.* 70: 168-170, August 1953.

A 57-year-old white man was under observation for recurrent multiple papillomas of the bladder of fifteen years duration. X-ray studies of the left kidney and ureter revealed multiple smooth, well defined filling defects throughout the course of the left ureter, which was explored surgically. It was found that these were compression defects produced by varicosity of the left ureteral vein. Following ligation of the varicosity, a normal ureterogram was obtained.

The differential diagnosis of filling defects of the ureter, such as were present in this case, must include ureteritis cystica, tuberculous ureteritis, chronic non-specific ureteritis, ureteral tumors both benign and malignant, and para-aortic lymph node enlargement causing extrinsic pressure on the ureter.

Three roentgenograms.

WYNTON H. CARROLL, M.D.
Shreveport, La.

Evaluation of Size of Bladder Neoplasms. C. D. Brunkow. *J. Urol.* 70: 234-236, August 1953.

The author's technic for radiological visualization of bladder tumors is as follows:

The cystogram is made by injecting 1 to 1 1/2 ounces of a thorium preparation (Umbrathor) into the bladder. After three minutes the bladder is filled to capacity with water and the catheter is clamped. The first exposure is taken in a supine position; this is followed by a second exposure in an oblique position. The bladder is then emptied, with several irrigations until the fluid is relatively clear. This should remove all the thorium solution except that which adheres to the tumor. Air is then injected into the bladder in the same volume as the fluid used for the opaque cystograms. This gives a contrasting pneumocystogram with the maximum amount of information preoperatively. The bladder tumors are coated with the radiopaque thorium solution and the remainder of the bladder is distended with air.

Four roentgenograms.

WYNTON H. CARROLL, M.D.
Shreveport, La.

A Study of the Radiation Hazard in Urology. Robert B. Nagle and Edward L. Peirson. *J. Urol.* 70: 338-341, August 1953.

The authors warn that radiation hazard should be carefully checked, especially in installations in which old or poorly protected equipment is employed. Weekly exposure at the Salem Hospital (Salem, Mass.) was measured by film badges placed at various distances from the cystoscopic table. It was apparent that, even with modern equipment, the urologist who does seven to ten retrograde pyelogram series weekly risks overexposure if no protective measures are taken. [The average number of exposures per series is not stated.]

With the operator remaining seated at the foot of the cystoscopic table, the average weekly exposure (7.4 series of pyelograms) was 278 milliroentgens, which is dangerously close to the maximum permissible, i.e., 300 milliroentgens. Stepping back just 18 inches cut the exposure some 75 per cent. This same degree of protection was obtained by limiting the size of the x-ray beam with a rectangular metal shield mounted in the throat of the tube; exposure then averaged only 76 milliroentgens. If he uses a lead shield, the urologist who does fewer than 25 pyelogram series a week will not exceed the permissible level even if he remains seated at the foot of the table.

These findings were confirmed by a similar experiment at a second hospital with different equipment.

Two drawings; 2 tables.

C. M. GREENWALD, M.D.
Cleveland Clinic

THE SPINAL CORD

Diagnosis of Spinal Tumours by Means of Gas Myelography. Sven Odén. *Acta radiol.* 40: 301-313, August-September 1953.

As a medium for myelography, gas has several advantages. It is not dangerous and there is no hypersensitivity or toxic after-effect on the membranes, with residual adhesions and granuloma formation. Examinations may be repeated, and fluoroscopy is not needed. Gas myelography is more time-consuming and more exacting for the patient than iodized-oil myelography, limiting its use in older people, and the films must be technically good. Subjective symptoms, as headache and nausea, are somewhat more pro-

nounced with gas. Both the positive contrast media and gas cause a slight increase in the protein and cells in the cerebrospinal fluid and a slight rise in temperature.

The author describes in great detail the technic of injection and examination. Since 1938, more than 2,100 gas myelographies have been performed at the Serafimer Hospital (Stockholm), and the results obtained in a five-year period, from 1947 to 1951, are presented. In that period more than 800 examinations were made. Positive radiographic findings (excluding herniated disks in the cervical and lumbar regions) yielded 115 cases with positive findings, all verified by operation or at autopsy. This number included 24 intramedullary and 88 extramedullary lesions. Of the latter, 59 were intradural and 29 were extradural. There were, in addition, 1 meningocele and 2 cases of kyphotic myelopathy.

According to the author, the most important objective of myelography is to demonstrate a possible spinal change, tumor, or other lesion and to establish its level. Whether it is extradural, juxtamedullary, or intramedullary is of less practical importance. In 109 (94.9 per cent) cases the exact level was established; in 6 cases the radiologic and operative findings did not agree.

Incorrect radiologic diagnosis depends upon two factors, the human and the "methodic." The human factor implies an inadequate examination by the radiologist, misinterpretation or failure to recognize a change. The methodic factors include errors in diagnosis because the changes could not be seen either during fluoroscopy or on subsequent films, although the examination was technically adequate. Of the 6 incorrect diagnoses, 4 were attributed to the human factor when the films were reviewed; the 2 remaining cases could not be attributed to this factor.

According to the author, gas myelography is just as dependable as examination with an opaque medium for the diagnosis of expanding lesions of the spinal canal. A review of various series shows that myelography, regardless of the method, has a reliability of approximately 95 per cent. A more detailed localization of tumors, as intra- or extramedullary, is somewhat more difficult with gas than with opaque contrast media. An adequate localization could be made definitely in 30 cases only, and these were mostly intradural juxtamedullary lesions. Lately, tomography has been employed to improve this method of examination.

Twelve roentgenograms; 1 photograph.

JULIAN O. SALIK, M.D.
Baltimore, Md.

Spinal Meningiomas and Neurofibromas. J. W. D. Bull. Acta radiol. 40: 283-300, August-September 1953.

The author reviews the literature on spinal meningiomas and neurofibromas and presents his material, consisting of 111 cases, 59 meningiomas and 52 neurofibromas. The average age incidence for meningiomas was about fifty years, more than 90 per cent of these tumors being seen in patients over thirty-five. Neurofibromas occurred in a younger group. There was no marked sex preponderance for neurofibromas, but 85 per cent of the meningiomas occurred in women. Nearly all the meningiomas involved the thoracic portion of the spinal canal, while the neurofibromas were diffusely distributed, except for the absence of any involving the first cervical nerve.

Neurofibromas were not calcified, whereas calcifica-

tion and/or ossification in spinal meningiomas is very common. This is easily seen histologically, but it is difficult to detect on films, as dense calcification is necessary before it will become visible in a tumor surrounded by such heavily calcified tissue as a vertebra. If calcification is demonstrable, it is helpful in making a diagnosis, but other types of spinal tumors may also calcify in rare instances. When a definite increase in the interpedicular distance is noted, this would indicate the presence of a space-occupying mass at that level.

Only 6 out of the 59 meningiomas showed changes on routine roentgen examination: in 2 instances calcification was noted, and in 5 there was an increase in the interpedicular space. Most meningiomas are located intradurally or within the arachnoid space; about 10 per cent are extradural; these tend to be malignant and can be differentiated from others by myelography.

Because so few meningiomas show changes on routine roentgenography, it is most important to use myelography for their diagnosis. The author employs Myodil, which he considers relatively innocuous. Usually about 5 ml. of the medium is used, but less if a complete block is suspected. When the tumor lies to the right or left, the cord may usually be seen displaced to the opposite side. It is a little more difficult to differentiate tumors situated posteriorly from those lying anteriorly. The latter are the most difficult to remove without damaging the cord. In the author's series, a little less than 10 per cent lay anteriorly. Meningiomas, as a rule, are not very large.

Neurofibromas produce a very different picture: they grow on spinal nerves or their root filaments and may attain a considerable size. Such tumors may be bilobate (dumbbell) the two lobes being connected by a narrow isthmus which is usually produced by bone pressure, classically the vertebral exit foramen. Two types of neurofibroma do not, as a rule, produce changes on routine films: (a) those which are intradural and not large enough to splay the pedicles and (b) those which are entirely extraforaminal. The juxtaforaminal tumors in the dorsal region may, however, erode the head and neck of the adjacent ribs.

Of 53 neurofibromas seen in 52 patients, 24 (45 per cent) produced changes on the routine films. Of these 24 tumors, 18 were extradural. Six of these arose from the second cervical nerve root and widened the interlaminal space between the atlas and axis. This separation of the laminae was plainly seen in the lateral views. Three others were also located in the cervical region, widening the exit foramen at C 3-4, C 4-5, and C 6-7, respectively. Tumors between C 3 and C 7 are usually seen satisfactorily only in oblique views. Seven tumors were present in the thoracic region, 5 eroding both pedicles and ribs, indicating their bilobate nature. Only 1 extradural tumor lay in the lumbar region and 1 in the sacral region. The latter was very large and the film disclosed a widening of the canal in this region.

Six intradural tumors also produced changes seen on routine examination. Two were cervical, lying at the level of C 3 and C 5, respectively, and both showed widening of the exit foramina. On these grounds, they were mistakenly believed to be dumbbell tumors.

Of the 29 neurofibromas which failed to produce changes demonstrable on routine roentgen examination, 5 were extradural. The 24 intradural tumors could be localized by myelography, but often it was impossible to differentiate them from meningiomas.

In his discussion the author compares the radiological

findings of spinal neurofibromas and acoustic neuromas. About 80 per cent of the latter manifest themselves radiologically by widening of the internal auditory meatus. The spinal neurofibromas have a greater variety of anatomical sites than acoustic tumors. The majority of intradural tumors produce gross neurological signs by pressing upon the cord before causing pressure erosion on the bones. Those situated more peripherally along the nerve can grow to a considerable size without necessarily damaging the cord, and yet during growth may cause quite gross bone destruction. In his general conclusions the author states that if

more than two adjacent vertebrae show radiological changes the tumor is not very likely to be a meningioma or neurofibroma. Myelography is often necessary to indicate the level of the lesion and its position relative to the cord, to exclude an intramedullary lesion, and differentiate an intradural from an extradural tumor. If the block to the contrast substance is incomplete, it may be possible to delineate the whole of the tumor, or at least the upper and lower poles.

Nineteen roentgenograms; 1 graph; 1 table.

JULIAN O. SALIK, M.D.
Baltimore, Md.

RADIOTHERAPY

Fourteen Years of Supervoltage Therapy in the Swedish Hospital, Seattle, U.S.A. F. Buschke. Schweiz. med. Wchnschr. 83: 641-645, July 11, 1953. (In German)

In 1932 a unit operating at 800 kv.p was installed in the Swedish Hospital of Seattle, Wash. Upon the basis of his personal experience with 1,224 patients, plus follow-up studies of 492 treated before his arrival at the clinic, the author concludes that supervoltage therapy holds no peculiar or qualitative advantage over conventional treatment, but that it does offer quantitative advantages in certain situations. The latter are found in deep tumors, in treatment through bone, in single-field therapy, in cases previously inadequately irradiated, and when irradiation is to be combined with surgery.

In carcinoma of the cervix the five-year symptom-free period is some 10 per cent better with 800 kv.p. therapy than with 200 kv.p. In thin individuals with this disease the limiting radiation factor is the intestinal mucosa, and the advantage of 800 kv.p. is negligible. The gain comes in obese patients. One can reach a cancerocidal dose readily before damaging the skin. Anaplastic infiltrating bladder carcinoma can be given a tumor dose of 6,000 r through three ports in forty-five days. Likewise, it is relatively easy to deliver 6,000 r to a cancer of the esophagus, an almost impossible task with conventional therapy. The author claims 3 apparent cures in 14 attempts at cancer of the esophagus. Carcinoma of the trachea and of the vagina exemplify other locations suitable for supervoltage therapy.

Tumors of the paranasal sinuses, the nasopharynx, and the pituitary gland must be irradiated through bone. One can administer the required 6,000 r to an epidermoid carcinoma, or the 5,000 r to a lympho-epithelioma, with intermediate therapy, but it is far easier, and is less damaging to the skin, to use 800 kv.p. In this range bone absorption and scatter may be ignored.

Certain growths of the tongue, the oral cavity, and the salivary glands are more satisfactorily treated with a single field which includes both the primary and the regional nodes. Because of greater skin tolerance, it is possible to deliver with supervoltage 5,000 r in thirty days through a single port. This same skin tolerance permits retreatment of cases that one would not dare attempt at 200 kv.

Supervoltage therapy is limited not by the skin but by the deep structures. Failure to recognize this has resulted in deaths and in irreparable damage. The lesser skin damage has permitted treatment of approxi-

mately 10 per cent more patients as compared with the lower voltage. An additional unknown number must be considered in those who completed their course under 800 kv.p. but probably would not have under 200 kv.p. because of radiation sickness. The best recommendation, however, is that once a radiologist has had supervoltage available, he can scarcely get along without it.

WM. F. WANGNER, M.D.
Royal Oak, Mich.

Roentgen Treatment of Gliomata. Martin Lindgren. Acta radiol. 40: 325-334, August-September 1953.

The author reports his results in 120 histologically proved cases of glioma treated by irradiation during the years 1946-51. Of the 120 patients, 28 were still alive on Sept. 1, 1952, but only 14 of these had been followed for more than two years; 13 had returned to their usual work, and 12 were partially disabled. Thirty-three patients died within a year of treatment.

The histologic grading was in accordance with Ringertz's classification. Astrocytomas were found to be the least malignant and glioblastomas the most malignant.

Irradiation was given through several fields, for a dose of 5,000 to 7,000 r. The skin dose per field was at most 4,000 r, including back-scatter. The target-skin distance was 50 to 60 cm. Other factors were 170 kv., 15 ma., 0.5 mm. Cu plus 1.0 mm. Al filtration, 0.9 mm. Cu h.v.l. The fields measured about 8×8 cm. One field was treated per day, with an initial dose of 500 r, except in cases of medulloblastoma and ependymoma, for which the skin dose was 300 or 400 r. Usually 2,500 or 3,000 r per field were delivered in the first series and one month later a further 1,000 or 1,500 r. The total treatment time was usually sixty to eighty days.

In his discussion the author emphasizes that it was attempted to deliver an adequate tumor dose within a reasonably short period. In his experience a tumor dose of 7,500 r spread over eighty days will not produce a more favorable biologic effect than 6,000 r spread over thirty days. It appeared that some astrocytomas are radiosensitive and may react favorably to the same dose as glioblastomas, that medulloblastomas and pinealomas often are extremely sensitive, and that the most favorable tumor dose in children is probably about 5,000 r spread over sixty to eighty treatment days. Irradiation can sometimes produce fairly long remissions even in astrocytomas.

In many instances, patients with different types of glioma enjoyed fairly long periods of relief, and though

postmortem examination did not disclose a complete disappearance of the tumor, it indicated a response of tumor tissue to irradiation. There was no destruction of normal tissue surrounding the tumor, which would indicate that the dose used over sixty to eighty days was "on the small side."

For adequate irradiation, it is necessary to know the histologic type of the tumor, its location, and size, and to begin treatment as soon after surgery as possible. The author concludes on the basis of this series that, except in moribund patients, all gliomas should be treated with multifield technic, limiting the initial dose to 200 r and carefully watching the patient for an increase in intracranial pressure. He favors a single uninterrupted course with larger doses—500 r or more—toward the end. The tumor dose should be varied according to the sensitivity of the glioma.

Four tables. JULIAN O. SALIK, M.D.
Baltimore, Md.

Radiation Therapy of Carcinoma of the Palate. Felice Perussia. *Radiol. clin.* 22: 334-340, July 1953. (In German)

The author reports the results of radiation therapy in 122 cases of carcinoma of the palate treated in his x-ray laboratory in Milan from 1928 to 1945. The importance of early diagnosis because of the rapid involvement of the lymphatics is particularly stressed. For carcinomas of the soft palate a three-year survival rate of 36 per cent was obtained, and a five-year survival rate of 27 per cent. The majority of these cases already showed lymph node metastases at the beginning of the treatment. Those cases confined to the soft palate without lymphadenopathy had a five-year survival rate of 68 per cent. The localized carcinomas of the hard palate showed a five-year survival rate of 43 per cent. With spread into the adjacent tissue this figure was reduced to 10 per cent.

The technic used for the treatment of the primary tumor as well as for the lymph-node metastases is described. Wherever possible, interstitial radium therapy is preferred. Otherwise radium applicators in dental molds are used. The method of choice for the involved lymph nodes is radical neck dissection.

Complications are sometimes unavoidable, as necrosis or late necrosis with perforation of the palate.

Four photographs. HERBERT C. POLLACK, M.D.
Chicago, Ill.

Treatment of the Meningeal System by Means of Radioactive Colloidal Gold and X-Rays. Charles L. Lewis. *Proc. Roy. Soc. Med.* 46: 653-655, August 1953.

A preliminary report on irradiation of the spinal cord and meninges by radioactive colloidal gold and a modification of the application of roentgen therapy is offered.

It is technically difficult to afford uniform irradiation of the spinal cord by x-rays because the cord lies at a varying distance from the skin. Two fields inclined to each other at a constant angle to the skin are suggested. The depth at which these fields intersect below the surface is then a function of their separation. By simple geometry, one can obtain for each case two such fields which will cross-fire on the cord at all levels. Where the fields are farthest apart, the dose at the cord will be lower, but there will be room on the skin surface between the two fields to utilize a third, direct field to compensate for this.

Radioactive colloidal gold has been found not to be irritant when introduced into the spinal fluid. It does not enter the blood stream in any appreciable quantity. Additional study of the neurological effects and the long-term effects must be made to provide further information before this can be recommended. Report is given of two cases in which 50 ml. and 74 ml. of active colloid were injected, in the first instance by lumbar puncture and in the second case by introduction into the left ventricle.

Three illustrations. D. DEF. BAUER, M.D.
Coos Bay, Ore.

Testicular Neoplasms: An Analysis of 113 Cases. D. A. Culp. *J. Urol.* 70: 282-295, August 1953.

This is an analysis of a series of 113 consecutive cases of tumor of the testis seen at the University of Iowa Hospitals in the period from 1930 to 1950, inclusive.

Sixty per cent of the cases fell in the age group between twenty and forty years. By far the most frequent presenting symptom was enlargement of the testicle. There was a history of trauma prior to the onset of a mass in approximately 25 per cent of the cases. The most frequent sites of metastases were: (1) the retroperitoneal nodes, (2) lungs, and (3) cervical lymph nodes. The Aschheim-Zondek test, performed in 31 cases, was positive in only 17.

The following tumor types were observed: seminomas, adult teratomas, embryonal carcinomas, teratocarcinomas, and chorioepitheliomas.

Treatment of these tumors has consisted of orchiectomy and radiation therapy, with seminomas responding best to this type of treatment. Seminomas accounted for 40 per cent of the series, while embryonal carcinoma, teratoma, and embryoma each accounted for about 15 per cent.

The five- and ten-year survival rates for the individual types were as follows:

	Five Years	Ten Years
Seminomas (39 cases)....	51.2%	30.7%
Teratoma (14 cases).....	50.0%	21.4%
Embryoma (13 cases)....	30.7%	8.3%
Teratocarcinoma (11 cases).....	9.09%	0

Of 17 patients with embryonal carcinoma, 11.7 per cent lived three years and 5.8 per cent fifteen years. For 24 cases of all types without metastases, the five-year survival rate was 70.8 per cent.

Six case reports are presented, each of which shows interesting and unusual manifestations of testicular tumor.

Twelve roentgenograms; 2 photographs; 12 table
WYNTON H. CARROLL, M.D.
Shreveport, La.

Wilms's Tumor in an Adult: Report of a Ten Year Cure. Geo. R. Livermore. *J. Urol.* 70: 141-145, August 1953.

A 37-year-old white woman had an exploratory operation on the right kidney on Jan. 15, 1941, because of a persistent slowly enlarging mass which had been present for three years. Biopsy of the mass revealed Wilms' tumor. Five months following this operation the patient was given x-ray therapy, receiving a total of 4,100 r through two 10-cm. round portals, one anterior and one posterior. The factors were 200 kv., 25 ma.,

5 mm. Cu filtration, target-skin distance 60 cm., and treatments of 250 or 300 r daily were given over a two-week period. Six weeks after completion of the x-ray therapy a right nephrectomy was performed. The response to x-ray therapy had been so satisfactory that the usual lumbar extraperitoneal approach was used without difficulty. The pathological diagnosis was confirmed by the Carcinoma Registry of the A.U.A. The patient was alive and well at the time of this report, over ten years following surgery.

Four examples of long survival in Wilms' tumor in the adult were found in the literature. Two of the patients were known to have survived eleven and fifteen years.

One roentgenogram; 2 photomicrographs.

WYNTON H. CARROLL, M.D.
Shreveport, La.

Case of Giant Follicular Lymphoblastoma (Brill-Symmers Disease) of the Pelvic Lymph Nodes Clinically Resembling an Ovarian Tumor, with Five-Year Freedom from Symptoms Following Radiation Therapy. J. H. Müller. *Radiol. clin.* 22: 311-320, July 1953. (In German)

Giant follicular lymphoblastoma has been given various names. It was called "generalized follicular hyperplasia of the lymph nodes" by Brill, "malignant follicular hyperplasia" and later "follicular lymphoblastoma" by Baehr, "giant follicular lymphadenopathy" by Symmers, "lymphoid follicular reticulosis" by Scott and Robb-Smith, and "giant follicular lymphoblastoma" by Rüttner and Albertini. The disease may develop either in a benign or a malignant direction. Transition into sarcoma, especially reticulosarcoma, has been observed in a high percentage of cases. Giant follicular lymphoblastoma, therefore, is often regarded as a pre-sarcomatous condition.

This disease is more frequently encountered in men than in women, and especially in the age group of forty to sixty years. It usually begins with localized enlargement of a group of lymph nodes, the most frequent sites being the cervical, axillary, and inguinal regions. Primary localization in the iliac lymph nodes is rather unusual. As the process progresses, new groups of lymph nodes are involved, leading to a generalization of the lymphadenopathy. The sedimentation rate is usually increased but not extremely high.

Brill-Symmers disease has a high radiosensitivity, which, however, is not identical with high radiocurability. Small doses of 100 to 150 r will lead to a regression of the enlarged nodes. To obtain a cure in a case of localized giant follicular lymphadenopathy, however, intensive radiation therapy, with extremely heavy dosage and large portals is required.

The author's patient, a 46-year-old white woman, was operated upon because of a suspected right ovarian tumor. On laparotomy both adnexa were normal but an irregular soft tumor, the size of an orange, was found on the right anterior wall of the pelvis. A portion of this tumor was removed for histologic studies. The pathological report was giant follicular lymphoblastoma of the iliac lymph nodes.

Intensive combined x-ray and radium therapy was instituted, and in addition the patient received Urethan. The following factors were used: large lower abdominal and sacral portals, 20 × 20 cm.; skin-target distance 80 cm.; Maximar 400 kv.; 5 ma.; 3.0 mm. Cu plus 1.0 mm. Al filtration. Each of four portals received 2,000 r, fractionated, within forty-five days, for a

tumor dose of 3,400 r. This was followed by intrauterine and vaginal radium therapy yielding an additional 1,000 gamma roentgens at the tumor. After an interval of twenty days (because of diarrhea) x-ray therapy was resumed, with an additional tumor dose of 600 r. The total tumor dose from all sources was about 5,000 r.

At the time of the report the patient had remained clinically free of symptoms for five years. Absence of recurrence was anatomically verified in the course of an operation for acute appendicitis.

One photomicrograph.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

Radiation Therapy of Paget's Disease of the Breast. Hans v. Braunbehrens. *Radiol. clin.* 22: 236-241, July 1953. (In German)

The author reports the use of contact x-ray therapy in a case of Paget's disease of the nipple. A 50-year-old white woman complained of a persistent eczema-like condition of the left breast for more than two years. The process progressed continuously and finally led to erosion of the nipple and areola. On the first examination by the author the diseased area was covered with scales and crusts. There was no evidence of lymph node involvement in the lateral breast wall, axilla, supraclavicular or infraclavicular area. Biopsy revealed typical Paget's cells.

Because of complicating heart disease with cardiac decompensation, radical breast surgery appeared contraindicated. As the lesion was confined to the nipple and areola and there was no evidence of regional lymphadenopathy, contact x-ray therapy was selected as the method of choice. In accordance with the Chaoul, technic, treatment was given at 5 cm. distance, 60 kv. 4 ma., with a circular cone 4.5 cm. in diameter, which completely covered the lesion. Daily treatments of 600-800 r were administered up to a total dosage of 15,200 r within twenty-four days. The ensuing radiation dermatitis healed without complications.

Examination of the treated area six months later revealed a smooth, slightly atrophic skin. There was no evidence of pathological findings in the breast or of regional lymph node involvement. The last examination, two years after contact therapy, showed the same favorable result.

The author is of the opinion that contact x-ray therapy should be considered the method of choice as long as Paget's disease is confined to the nipple and superficial surrounding area.

HERBERT C. POLLACK, M.D.
Chicago, Ill.

X-ray Therapy of Peripheral Tuberculous Lymphadenitis. Joseph N. Aceto, Kazumi Kasuga, and Stevens S. Sanderson. *Am. Rev. Tuberc.* 68: 157-164, August 1953.

Sixty-five patients with tuberculous lymphadenitis were treated with roentgen rays and the results were analyzed at the time of the final treatment or one month following it. Technical factors were as follows: 100 to 150 kv., 8 ma., 3 mm. Al filter. Dosage ranged from 60 to 200 r (in air) given at weekly intervals over a period of from three to twenty weeks; total dosage varied from 300 to 1,800 r (in air). Analysis of results showed that 44 of a total of 87 lesions regressed or healed; 30 of 47 fluctuant and/or draining lesions and 14 of 40 hard nodules responded favorably. The

greatest number of successfully treated fields with both hard and draining nodes fell within the dosage range of 400 to 699 r per field.

No significant deleterious effects were noted in any of the patients treated. Several lesions regressed after the immediate post-irradiation period, but were not included in the statistical analysis so that results were

probably somewhat better than given above. The authors conclude that irradiation is a valuable adjunct to antimicrobial agents in the treatment of patients with tuberculous lymphadenitis, particularly when the nodes are fluctuant or draining.

Three tables.

JOHN H. JUHL, M.D.
Minneapolis, Minn.

RADIOISOTOPES

Serum Concentrations of Radioiodine in Diagnostic Tracer Studies. Michael C. Barry and Albert E. Pugh. *J. Clin. Endocrinol & Metab.* 13: 980-988, August 1953.

Serum radioiodine concentrations one and four days after oral administration of 50-microcurie tracer doses were studied in 74 euthyroid and 9 hyperthyroid patients. The normal range of urinary excretion of radioiodine was 34 to 80 per cent. A measure of the variation of serum radioactivity with time was devised:

$$i = \log_{10} \left[\frac{(P_4)^2}{P_1} \times 10^7 \right]$$

where P_1 is the serum radioiodine concentration per milliliter in percentage of administered radioactivity at one day and P_4 is the same value at four, five, or six days. Using statistical methods it was determined that a patient with a value of i greater than 3.44 may be considered to be not euthyroid. All of the 9 hyperthyroid patients had a value of i above the normal range. The serum radioiodine concentration in 2 cases of cirrhosis of the liver was similar to that in hyperthyroidism.

The authors believe that the value of i , as a measurement of serum radioiodine concentration in this study, successfully divides the euthyroid from the hyperthyroid patients and may predict accurately a favorable response to specific thyroid therapy in hyperthyroid patients. Each of the 9 hyperthyroid patients was treated by thyroidectomy or radioiodine in therapeutic doses and showed subsequent clinical improvement.

Evidence is presented which suggests that higher than normal serum radioiodine concentrations in hyperthyroidism at four days and longer after administration of tracer doses represent iodine incorporated into circulating thyroid hormone.

Two graphs; 4 tables.

RICHARD F. McCLURE, M.D.
Palos Verdes Estates, Calif.

Evaluation of a Thyroid Panel. Practical Application of Scintillation Counter in Diagnosis of Diseases of the Thyroid. T. F. Barrett, H. Peck, F. K. Bauer, R. L. Libby, and S. R. Jarrett. *J.A.M.A.* 152: 1414-1417, Aug. 8, 1953.

The thyroid uptake of tracer doses of I^{131} is generally considered to have equal importance with the basal metabolic rate, the serum cholesterol level, and serum protein-bound iodine (PBI) determination. Recent technical improvements have made possible the use of tracer amounts as small as 1 microcurie of I^{131} for studying thyroid function. The uptake procedure outlined makes possible the handling of a large number of patients in a thyroid diagnostic clinic.

The patients receive a 2 μ c. dose of carrier-free I^{131} prepared in capsule form, and uptake studies are performed six to twenty-four hours later.

The authors report a pilot study of 116 healthy control subjects and 213 patients. Every effort was made to explain false values as a result of thyroid medication, iodine medication, or the use of iodine-containing compounds in roentgenologic studies.

The results of this study show that the basal metabolic rate correlates reasonably well with the tracer test in unequivocal cases of hyperthyroidism or hypothyroidism. The serum cholesterol determination is valuable in patients with hypothyroidism but not in patients with hyperthyroidism. The results of the PBI determination and tracer study compare reasonably well in most instances. In the authors' experience, these two procedures are the best available laboratory tools for confirmation of a clinical diagnosis of thyroid disease.

Five tables.

M. HARLAN JOHNSTON, M.D.
Jacksonville, Fla.

A Multiple-Counter System for Isotope Encephalometry. Douglas A. Kohl. *Nucleonics* 11: 16-19, July 1953.

The author describes a multiple counter system for brain tumor detection with I^{131} which would tend to eliminate dependence upon the skill and interpretative ability of the person conducting the test. This consists of 8 scalars and 18 detectors and makes possible the use of fixed points, with strict reproducibility. It aids in the detection of bilateral asymmetrical radioactivity to a degree that is not thought possible with single detector methods.

One photograph; 5 tables.

S. F. THOMAS, M.D.
Palo Alto, Calif.

Deposition of Airborne Radioiodine Vapor. A. C. Chamberlain and R. C. Chadwick. *Nucleonics* 11: 22-25, August 1953.

One avenue of hazard due to the release of volatile fission products in the atmosphere from radiochemical laboratories, separation plants, and other sources, is through absorption by vegetation. I^{131} is particularly hazardous because of its high fission yield, its volatility, and its high specific concentration in the thyroid gland of animals.

In the experiments described in this paper, I^{131} in carbon tetrachloride was sprayed as a mist over a grass air field. The resulting cloud was sampled at selected points down wind by drawing air at a known rate through caustic soda bubblers. Petri dishes containing filter paper were exposed and grass samples were obtained. The resulting deposition at different locations under various conditions is illustrated in both tables and graphs. It was noted that the rate of deposition of I^{131} vapor on filter paper was controlled by the rate at which diffusion brought the molecules into contact with the paper.

The activity of the vegetation appeared to decay with a half-life of five or six days, as compared to the physical half-life of eight days. Calculations on the basis of the amount of grass eaten per day by animals have indicated the maximum permissible level of I^{131} in vegetation of 1×10^{-4} microcuries/gram. The result of these experiments indicated that air concentrations of only 1×10^{-12} microcuries/c.c. would produce this calculated permissible level in vegetation. This is less by a factor of 3,000 than the permissible level for human inhalation and thus is the limiting factor of I^{131} concentration over pasture areas.

Five illustrations; 5 tables.

JOHN S. LAUGHLIN, PH.D.
Memorial Center, New York

The Deposition of Radiophosphorus in Fractured Bones in Rats. G. W. Wilkinson and C. P. Leblond. *Surg., Gynec. & Obst.* 97: 143-150, August 1953.

The authors studied the uptake and deposition of radiophosphorus in rats which had received a complete simple fracture of the left humerus and an incomplete fracture of the left tibia. The rats were sacrificed four hours after receiving 200 μ c. of P^{32} at one, four, eight, twelve, and nineteen days after production of the fractures. Both normal and fractured bones were removed and studied by means of quantitative Geiger counter measurements and autoradiograms.

The specific activity of the fractured bone was higher than that of the corresponding intact bone. The greatest uptake of P^{32} was observed four days after fracture. The diaphysis of the intact bone also showed an increased uptake of radiophosphorus, though to a lesser extent, with a gradual return to normal at the end of nineteen days.

Radioautographs revealed that the trabeculae of new bone, which appeared two to four days after fracture, fix radiophosphorus most actively and must, therefore, calcify rapidly and soon play a role in strengthening the fractured bone.

Geiger counter measurements revealed uptakes not only in the diaphyses of the intact bones, but also in the epiphyses. This is explained on the basis of reconstruction of bony tissue extending to other bones than those injured, and is attributed to changes of internal bony pressure secondary to use of body and limbs following fracture.

Five radioautographs; 1 graph; 2 tables.

A. EDWARD O'HARA, M.D.
University of Pennsylvania

The Blood Volume in Pregnancy as Determined by P^{32} Labeled Red Blood Cells. Nathaniel I. Berlin, Carl Goetsch, Grace M. Hyde, and Robert J. Parsons. *Surg., Gynec. & Obst.* 97: 173-176, August 1953.

It has long been known that the concentration of red cells, as determined by hemoglobin, red cell count, and hematocrit, shows a decrease during pregnancy, the so-called physiologic anemia of pregnancy. It is generally agreed that at the same time there is an increase in plasma volume and total blood volume. Caton and co-workers were the first to show directly a progressive increase in the total red cell volume by use of radioiron-labeled red cells (*Am. J. Obst. & Gynec.* 61: 1207, 1951. *Abst. in Radiology* 58: 631, 1952).

The present authors have employed P^{32} -labeled red cells in their studies of this problem. A modification of the method of Hevesy and Zarahn was used on 157

pregnant and 34 postpartum patients, only one determination being made on each person. Sixteen normal non-pregnant women were studied to establish normal levels.

By this method it was shown that there is an initial drop of 200 c.c. in the red cell volume during the first two months of pregnancy, followed by a progressive rise to 270 c.c. above normal, reaching a peak at the ninth month. A fall of 170 c.c. was noted in the last month before delivery, and a further decrease of 300 c.c. in the postpartum period.

A study of the plasma volume revealed a steady increase to a peak at the ninth month, when it is 1,200 c.c. above normal, and a drop of 190 c.c. prior to delivery. This is followed by a 780 c.c. drop in the immediate postpartum period, but it remains high even at six weeks postpartum (100 c.c. above normal). There is an initial drop in total blood volume during the first two months of pregnancy followed by a progressive rise.

The drop in total red cell volume indicates a true anemia during the first and second trimesters, not entirely due to hydremia. This study also suggests that the administration of supplemental iron has little or no effect on total red cell volume, and that the hematocrit is a grossly inadequate measure of the true volume of red cells.

Three graphs; 1 table.

A. EDWARD O'HARA, M.D.
University of Pennsylvania

Investigations to Determine the Union of Iron with Beta Globulin and Its Clinical Significance with the Aid of Fe^{59} . F. Wuhmann and B. Jasiński. *Schweiz. med. Wchnschr.* 83: 661-665, July 11, 1953. (In German)

It has recently been shown that a certain fraction of the plasma protein, specifically the beta globulin, is concerned with the transport of iron in the blood stream. This iron-binding fraction is called "transferrin" in Europe and "siderophilin" in America; it is identical with Cohn fraction 1V-7 and is also termed "metal-bound protein." It constitutes 2.5 to 3.0 per cent of the total plasma protein. Iron-free transferrin is colorless, while the iron-bound molecule is of a pinkish hue. This corresponds to observed phenomena in sedimentation tubes; it is well known that in iron deficiency anemias the serum tends to be pale.

Fe^{59} was administered either by injection or ingestion in the form of ferric chloride solution to both patients and animals. With its half-life period of forty-seven days and relatively low radioactivity, this is apparently safe. Blood was withdrawn in ten minutes, the serum was separated, and the protein fractions were then separated by electrophoresis over photographic paper. In four days the albumin, alpha 1, alpha 2, beta and gamma globulins yield an autoradiogram.

The iron actually does have a pronounced affinity for the beta globulin. The intensity of the uptake is greatest in sideropenia, somewhat less in the presence of infection, and least in an animal the blood of which has been saturated with iron prior to the administration of Fe^{59} . In the last instance one must presume that no free transferrin is left in the beta globulin. Once the beta globulin is saturated, the alpha 1, the alpha 2, and the gamma fractions will absorb some iron but not before. Albumin plays no role at all in iron transport.

Two patients, one with hemolytic anemia and one

with hepatorenal syndrome, showed an abnormal electrophoretic pattern: a diffuse spread of the Fe^{59} over the whole globulin spectrum. In terms of total quantity of transferrin, the most striking increase occurred in a case of sideropenic anemia.

A clinically more important phenomenon may be noted in patients with icterus. In jaundice due to hepatitis, the quantity of transferrin, as indicated by the uptake of Fe^{59} , is markedly reduced. In obstructive jaundice the quantity of transferrin is normal, and one obtains a normal electrophoretic pattern with the Fe^{59} concentrated in the beta globulin.

Ten illustrations.

WM. F. WANGNER, M.D.
Royal Oak, Mich.

Dosimetry of a Kilocurie Cobalt-60 Source. Sol Davison, Samuel A. Goldblith, Bernard E. Proctor, Marcus Karel, Billy Kan, and Charles J. Bates. *Nucleonics* 11: 22-26, July 1953.

Three chemical dosimeters (ferrous-feric, ceric-cerous, and methylene blue) and one physical dosimeter (adiabatic calorimeter) were used with the kilocurie cobalt-60 source at the Massachusetts Institute of Technology. The ferrous-feric dosimeter was found to be the best for routine use. It was accurate and simple to use and afforded reproducible results. The ceric-cerous dosimeter required very careful application to obtain reproducible results, while methylene blue was the simplest to handle but was much less precise. The adiabatic calorimeter is not suitable for routine use, but is an excellent instrument for establishing yields of the chemical dosimeters.

The results of this study support the yields for the ferrous-feric and ceric-cerous dosimeters reported by others, namely, about 20 and $3.3 \mu\text{M}/1/1,000 \text{ rep}_{\text{D}}$, respectively. Independent studies on cathode-ray dosimetry of a 3-mev Van de Graaff accelerator tend further to support these results. This is considered of importance in research now being conducted on the comparative microbiological effects of high-energy gamma rays, x-rays, and cathode rays.

Two illustrations; 4 tables.

S. F. THOMAS, M.D.
Palo Alto, Calif.

A Syringe Shield Used in Injecting Radioactive Gold. Paul Getzoff, John Hidalgo, and Joe Meyer. *J.A.M.A.* 152: 1431-1432, Aug. 8, 1953.

A new and simple syringe shield is described for use in injecting radioactive gold in the treatment of prostatic carcinoma. An ordinary 10-c.c. syringe is encased in a shield of lead, 7/16 in. thick, which fits into a brass tube 1/8 in. thick. The plunger of the syringe is driven by a drive screw, giving almost a "finger-tip" ease of injection. An additional feature is a guard placed on the needle so that the depth of injection is regulated.

Two photographs. M. HARLAN JOHNSTON, M.D.
Jacksonville, Fla.

Film Measurement of Beta-Ray Depth Dose. E. Tochilin and R. Golden. *Nucleonics* 11: 26-29, August 1953.

Under controlled conditions, photographic films can be used to measure the depth dose distributions produced by the absorption of beta rays in tissue-like material. These dose distributions can be determined

absolutely by extrapolation chamber measurements, but, since films are more readily available, their use for this purpose makes such measurements possible more generally.

The sensitivities of a variety of films have been determined experimentally for the beta rays from a variety of isotopes. The sources used include Ta^{182} , RaD plus RaE , Y^{91} , Sr^{90} plus Y^{90} , and Ru^{106} plus Rh^{106} . Details of the development, fixation, and washing of the films are given, together with the methods of density determinations.

A dependence of film density on energy was established and is plotted in a graph. The information given in the various graphs and tables makes it possible to use film with the necessary accuracy for depth dose measurements for clinical purposes.

Six figures; 2 tables. JOHN S. LAUGHLIN, Ph.D.
Memorial Center, New York

Isotope Handling Calculator. R. West. *Nucleonics* 11: 50-52, August 1953.

A convenient calculator for isotope handling is described. The calculator is in the form of a circular slide rule and is restricted to the use of seven of the most widely employed gamma-ray isotopes. The parameters which appear on the slide rule are the source strength in curies, the dose rate produced by the unshielded isotope, the thickness of the shield, the distance, and the dose rate at the point in question. The seven gamma-ray emitters for which this is designed are Na^{24} , Co^{60} , radium, Ta^{182} , Ir^{192} , Au^{198} , and I^{131} . All of the necessary data pertinent to these isotopes are incorporated in the various calculator scales. Examples of its use for different isotopes in different thicknesses of lead containers at different distances are given.

One illustration. JOHN S. LAUGHLIN, Ph.D.
Memorial Center, New York

Monitoring of Liquids for Radioactivity. W. M. Hurst. *Nucleonics* 11: 34-37, August 1953.

A continuous-flow radiation monitor with a calibration unit is described for monitoring radioactive contamination in liquids such as drinking water. Other possible applications include measurement of excretion of naturally occurring radioactive isotopes, and of radioactive gas concentrations, and determination of the rate of plating out of activity from solutions. The instrument has a sensitivity greater than that of the recommended maximum permissible level for drinking water contamination.

The monitor includes a radiation detector which is some form of a thin-walled Geiger counter. This is inserted in a water cell which has been so designed as to rotate the water as a wall around the counter. Considerable attention has been paid to the choice of materials and the effect of impurities.

For the detection of low-energy beta particles, the use of counters with continuous gas flow is described in detail. The calibration unit allows the use of solutions with a known beta or alpha activity to determine the absolute sensitivity of the detector. The apparatus has been used for several months, in conjunction with a mechanical recorder, to monitor drinking water. The application of the counter to detect the amount of potassium-40 in body fluids is also described.

Six figures. JOHN S. LAUGHLIN, Ph.D.
Memorial Center, New York

Economical Shielding for Multicurie Sources. R. F. Obrycki, R. M. Ball, and W. C. Davidson. *Nucleonics* 11: 52-53, July 1953.

The authors describe an ingenious method for shielding a 25-curie Co^{60} source. The source holder, on top of a source mover of soft iron, is submerged in mineral oil in a brass pipe sunk in the ground. Magnetic coils around the pipe are successively energized to raise the source to the position of use, the source mover serving as a plunger. The criteria met by this method are:

1. The source is in a sealed container.
2. The loading is done easily and safely.
3. Adequate shielding for protection is supplied with the Co^{60} source in the storage position.
4. The mechanism is "tamper-proof" and "fail-safe." If there is any failure in control, the source returns to storage position.
5. Dosage is controllable.
6. Safe removal and disposal of the source are possible.
7. Repair is easy and safe.

Three figures.

S. F. THOMAS, M.D.
Palo Alto, Calif.

Radioisotope Procedures with Laboratory Animals. Sam L. Hansard and C. L. Comar. *Nucleonics* 11: 44-47, July 1953.

Criteria for radioisotope investigations with small animals are outlined as follows:

1. Sanitation and good housekeeping practices.
2. Availability of essential equipment and facilities for handling and monitoring employed levels of radioisotopes.

3. Perfection of technics for the quantitative administration of activity to the animal.
4. Provision of facilities for animal restriction and maintenance and for separate quantitative collection of excreta.
5. Controlled area segregation of the experimental animal cages and equipment following administration of radioactivity.
6. Satisfactory disposal of all excreta, carcasses, and radioactive wastes.

For oral administration of isotopes, the animal is immobilized without anesthesia by grasping the head and shoulders firmly with the left hand, or by wrapping in a small towel. The mouth is opened by slight positive and upward pressure over the jaws by the thumb and forefinger. The stomach tube assembly is carefully inserted with the right hand and the syringe containing the radioactive material is introduced directly into the delivery tube. The dose is washed quantitatively into the stomach, and the animal is placed in the metabolism unit.

Methods of intraperitoneal, subcutaneous, intramuscular, and intravenous injection are also described, the last in considerable detail.

The management after dosage is of interest. Methods are detailed for collection of specimens of urine and feces in the case of mice, rats, guinea-pigs, rabbits, and dogs, with avoidance of contamination of one by the other, as well as means of prevention of "recycling" of nutrients in the case of rabbits.

A brief account of the collection of expired gases is also given.

Two photographs.

S. F. THOMAS, M.D.
Palo Alto, Calif.

RADIATION EFFECTS

Experimental Acute Radiodermatitis Following Beta Irradiation. I. Its Pathogenesis, and Repair. C. C. Lushbaugh, J. B. Storer, and D. B. Hale. *Cancer* 6: 671-677, July 1953. **II. The Inhibition of Fibroplasia.** C. C. Lushbaugh and J. B. Storer. *Ibid.*, pp. 678-682. **III. The Changes in Water, Fat, and Protein Content.** C. C. Lushbaugh and D. B. Hale. *Ibid.*, pp. 683-685. **IV. Changes in Respiration and Glycolysis.** C. C. Lushbaugh and D. B. Hale. *Ibid.*, pp. 686-689. **V. Histopathological Study of the Mode of Action of Therapy with Aloe vera.** C. C. Lushbaugh and D. B. Hale. *Ibid.*, pp. 690-698.

I. Pathogenesis and Repair: A study of the histopathology of acute radiodermatitis was made to clarify the sequence of events in its pathogenesis and repair. Two hundred and sixteen Sprague-Dawley rats weighing 250 to 300 gm. were exposed locally to beta radiation. The shaved abdomens of the anesthetized rats were exposed to radioactive strontium (Sr^{90}) and radioactive phosphorus (P^{32}). The Sr^{90} delivered 90 rep per second and the P^{32} delivered 4,500 rep per hour. Each animal was subjected to two exposures, one of 14,000 rep and one of 28,000 rep. Two animals were sacrificed every other day for a period of thirty-six days. The exposed abdominal skin surrounded by a one-inch zone of unexposed skin was dissected out, fixed, and stained with various stains.

The development and repair of ulcerative radiodermatitis following exposure to beta radiation was studied

morphologically. A four- to six-day latent period was noted. From the sixth to the twelfth day a progressive degeneration and necrosis, beginning in the superficial epithelium and spreading to the corium, was observed. The latter part of this period was characterized by eschar formation. The ulcerative defect was filled in by the less severely damaged tissue of the middle and deep corium being pushed to the surface by fibroplasia beneath it. A new epithelial covering was provided by upgrowth from the depth of the follicles and downgrowth of the superficial epithelium, and was usually complete by the twenty-fifth day. Healing was complete by the thirty-sixth day.

Specific stains for the presence of enzymes were made of the areas of radiodermatitis. Esterase, found normally in fat and follicular epithelium, began to diminish between the fourth and sixth days and was completely gone by the sixteenth day. The presence of lipase was not demonstrated until the formation of eschar, between the eight and tenth days. Alkaline phosphatase, normally found in the basement membrane and basal cells of the bulb and shaft of the hair follicles, was prominent in the irradiated area. Acid phosphatase was not found in normal skin, but was seen in the young actively proliferating fibroblasts in the areas of healing radiodermatitis.

Six photomicrographs illustrate the authors' observations.

II. Inhibition of Fibroplasia: An experiment was

designed to show whether a functioning deficit in fibroplasia occurred in acute ulcerative radiodermatitis following beta irradiation. One hundred and seventy-six albino Sprague-Dawley rats were divided into three groups, which were exposed to beta radiation from P^{32} , from 3,500 to 28,000 rep. Abdominal laparotomy incisions were made in exposed and adjacent unexposed areas and were immediately closed with stainless steel wire sutures. These surgical incisions were made one, two, and three days before, and one and two days after irradiation.

The ability of skin to heal was found to be markedly impaired after exposure to beta radiation. The authors noted that, while a normal cellular exudate developed promptly, fibroblasts failed to appear and proliferate in the irradiated area. If the surgical incision were made before the area was irradiated, the fibroblasts that began to proliferate were arrested and underwent changes that resulted in formation of giant anomalous forms. These changes were restricted to the irradiated areas, and their depth in the abdominal wall was dependent upon the dose of beta radiation delivered.

Two photomicrographs; 2 graphs.

III. Changes in Water, Fat, and Protein Content: The changes in water, fat, and protein content in the skin of Sprague-Dawley rats following beta irradiation were studied. A shaved circular area, 2.5 cm. in diameter, on the abdominal wall received 28,000 rep of beta radiation from a plastic disk containing P^{32} . From one to sixteen days after irradiation, 100-mg. aliquot samples of exposed skin and of normal skin 2 to 3 cm. distant were obtained. These were desiccated in a hot-air oven at 87° C. to constant weight and extracted with ether until no further weight loss occurred. The percentage of water, ether-extractable lipid, and "protein" were calculated on the basis of the dry weight, fat-free weight, and the original weight of skin residue.

The water and protein content of normal skin remained constant over the period of observation. The fat content of normal skin decreased during the first two days and then remained constant. No changes were noted in the irradiated skins until the sixth day, when the water content was elevated and the fat content lowered. On succeeding days, the water content continued to rise until it reached a plateau at 81 per cent of the wet weight of the skin. The fat content continued to fall, reaching its lowest level on the fifteenth day. The protein content of the irradiated skin did not decrease significantly until the thirteenth day. This increase in water and decrease in fat and protein content, which have been described as indicative of healing, reached a maximum on the thirteenth day. In contrast to surgical wounds, the changes in protein content of areas of ulcerative radiodermatitis are remarkably slow and of low magnitude.

Three graphs; 2 tables.

IV. Changes in Respiration and Glycolysis: The authors studied the effect of beta radiation on the skin in relation to carbohydrate metabolism. The skin of the abdomen of 185 male albino Sprague-Dawley rats was exposed to beta radiation of 14,000 to 28,000 rep from Sr^{90} which had a delivery rate of 90 rep per second. Skin strips 1.0 cm. in width were dissected from the abdominal wall and placed in cold Ringer-phosphate solution and sliced into strips 1.0 mm. in width. These strips were mixed and enough selected and blotted dry to form a 100-mg. aliquot for a Warburg vessel. Determinations of the rate of oxygen uptake and anaerobic

glycolysis were made by the usual manometric methods of Warburg.

Significant changes in the rate of oxygen consumption and glycolysis were found following exposure of the skin of the rats to beta radiation. Stimulation of respiration and glycolysis was noted during the second day after exposure, far in advance of any microscopic signs of injury. The rate decreased to normal by the sixth day and fell far below normal as necrosis developed. With the onset of healing, a rise in glycolysis was noted. The authors interpreted these changes as manifestations of severe disturbance in normal enzyme processes, which occurred immediately after irradiation, possibly as a result of destruction of enzyme regulatory systems.

Two graphs.

V. Histopathological Study of the Mode of Action of Aloe Vera: For evaluation of the effect of aloe vera on the rate of healing of experimentally produced ulcerative radiodermatitis, the backs of albino rabbits were shaved and exposed to beta radiation from a Sr^{90} applicator 5/8 inch in diameter, delivering 90 rep per second. In a therapeutic-trial group the shaved area was divided into four quadrants and each quadrant exposed to 14,000 and 28,000 rep. One quadrant was treated with daily applications of whole leaf aloe vera, another with aloe vera ointment, a third with dry gauze dressing only, and the fourth was left uncovered. The progress of these lesions was observed for four months. In a group studied histologically, the central area of each quadrant received 14,000 rep from a similar Sr^{90} source. Two of the four quadrants were treated with aloe vera ointment and the other two quadrants were left unprotected and untreated. Under Nembutal anesthesia, an untreated and a treated lesion were removed from 2 of 10 rabbits at intervals of from five to forty days after irradiation. These segments of skin were fixed and sections were made of a strip of skin obtained along a diameter of the fixed lesion, with normal skin at both ends. The microscopic appearance of treated and untreated lesions was compared.

The authors found that aloe vera enhanced the healing process in ulcerative radiodermatitis in rabbits following beta irradiation. They concluded that aloe vera shortened the latent period, promoted re-epithelization more rapidly, overcame the inhibition of fibroplasia, and decreased telangiectasia. The mechanism of action of the drug is not explained. It is suggested that it may contain substances which are stimulatory both to delayed development and delayed healing of ulcerative radiodermatitis.

Ten photographs; 6 photomicrographs.

ROSS H. SMITH, JR., M.D.
Mayo Foundation

An Investigation into the Relationship between Physiologically Low Leucocyte Counts and Sickness Absence. Frances M. Turner. Brit. J. Radiol. 26: 417-422, August 1953.

A study was made of the medical and casualty records of employees of the Atomic Energy Research Establishment, Harwell, England. Rates of absence from work due to sickness during a period of 2.7 years in 154 workers with a persistently low leucocyte count (under 5,000), were compared with a series of the same size, age, and sex distribution but with normal white counts. Time lost was significantly lower in the group with low white counts. The author suggests that a low

white count is not necessarily a contraindication to working with ionizing radiations.

Eight tables. SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Hazard Evaluation and Control After a Spill of 40 Mg. of Radium. R. K. Skow, V. V. Vandivert, and F. R. Holden. *Nucleonics* 11: 45-47, August 1953.

The U. S. Naval Radiological Defense Laboratory was called upon for assistance in decontamination after a glass capsule containing approximately 40 mg. of radium sulfate was unknowingly broken in a student laboratory. Sixteen hours after the accident, widespread contamination of the building and of the students' clothing and personal possessions was found. Microgram amounts of radium were found on the hands of some of the students. The soles of shoes, pockets, and lapels commonly had alpha counts as high as 200,000 disintegrations per minute. Automobiles and homes were heavily contaminated. In the room in which the accident occurred, air-borne long-lived alpha activity was approximately three thousand times the permissible level.

Decontamination of the bodies of the students was accomplished initially with soap, water, and citric acid, and finally with a special solution, which is described. Wool clothing had to be discarded except where initial activities were relatively low. Cotton clothing and shoes were decontaminated with repeated cleaning.

Permeable material in general had to be discarded. Altogether approximately 200 drums of carpets, linoleum, etc., were collected and sunk in an approved ocean area. The initial levels of contamination of various objects and air and the effect of the decontamination procedures are shown in tables and graphs. Three months after the accident, the building was sufficiently decontaminated for re-occupation.

JOHN S. LAUGHLIN, PH.D.
Memorial Center, New York

Bone Marrow Changes in Patients with Chronic Leukemia Treated by Splenic X-irradiation. Preliminary Report. F. W. Gunz. *Blood* 8: 687-692, August 1953.

A study was undertaken to determine the changes that take place in the bone marrow of leukemic patients treated to the spleen by x-rays. Repeated bone marrow aspirations were made on 15 patients suffering from chronic myeloid leukemia and on 4 patients with other diseases. Sternal puncture was employed in all cases except one, in which the iliac crest was punctured. The aspiration was done before and eighty minutes after the first treatment, and twenty-four hours after the last treatment.

The preliminary results showed that changes in the composition of the bone marrow follow local x-irradiation of the spleen in some patients with chronic myeloid leukemia. This is not unexpected, since the usual clinical response consists of involution of the enlarged spleen, a reduction in the elevated myeloid cell count in the peripheral blood, and increase in the red cell count. It was also shown that inhibition of mitosis among the myeloid cells of the bone marrow can follow local irradiation of the spleen in these same patients, even though precautions have been taken to protect the marrow from direct irradiation. Mitotic inhibition in the marrow was demonstrated eight minutes after the irradiation of the spleen. This has not hitherto been described, and

further confirmation would be important. No inhibition was noted among the erythroid cells. The inhibition of mitosis was found to be temporary, and could not be shown twenty-four hours after the last treatment in any of the cases investigated.

As a control, 4 patients (3 with diseases other than myeloid leukemia) were irradiated over parts of the body other than the spleen. No significant changes were found to occur in this group, with the possible exception of the patient with chronic myeloid leukemia.

Five tables. FRANK T. MORAN, M.D.
Auburn, N. Y.

The Physical Growth and Development of Children Who Survived the Atomic Bombing of Hiroshima or Nagasaki. William Walter Greulich, Cathrine S. Crimison, and Margaret L. Turner, with the technical assistance of Mildred L. Greulich and Yoshio Okumoto. *J. Pediat.* 43: 121-145, August 1953.

This study of children of Hiroshima and Nagasaki represents a tremendous volume of work and, in time, will prove to be a significant contribution to long-term radiation effects in the younger age group. It constitutes, for all practical purposes, a laboratory type of experiment with human beings as experimental subjects submitted to a devastating form of warfare. The conclusions reached are quoted:

"Our findings indicate that the physical growth and development of the children who survived the atomic bombing of Hiroshima or Nagasaki were adversely affected by that experience and that some of the resulting retardation in their height, weight, and skeletal development was still evident at the end of 1950, five and one-half years after the bombing.

"It should be emphasized that these deficits still persisted despite the marked improvement in the food supply and in the general economic conditions that had taken place during the intervening years. It should be remembered, also, that as late as the end of 1950 and the beginning of 1951, the Hiroshima children and those of the Nagasaki exposed group were still somewhat below the average heights and weights that the same sex and age in Japan as a whole had achieved by 1946 and 1947, and which, presumably, the latter had surpassed in the interim.

"In general, the boys tended to be more retarded than the girls of the same group. This is consistent with our observations in Guam and elsewhere that boys appear to withstand less successfully than girls the rigors of an unfavorable environment and to require a longer period than they to recover from its untoward effects.

"The adverse effects on the growth and development of the Hiroshima and Nagasaki children disclosed in this study probably derived from a variety of causes. These include the harmful action of the thermal and other types of radiation from the atomic bomb itself; the other physical injuries incurred at the time of the bombing; the severe psychological traumas which resulted from witnessing a horrible form of violent death that, in many instances, claimed parents, siblings, neighbors, and friends; and the subsequent severe disruption of the economy with the extreme poverty, the widespread malnutrition, and the other evils that follow in the wake of such an overwhelming disaster. It is futile to attempt to dissociate these factors or to allocate to each its proper share of responsibility for the effects observed. They are, to a large extent, in-

separable and inevitable consequences of the kind of cataclysm which produced them."

The technical aspects of the study are well presented, and the results are set forth in tables and graphs. [While the authors' conclusions are adequate for a day-to-day working knowledge for the radiologist, an editorial appearing in the J.A.M.A. for Sept. 19, 1953, on the effects of radiation on the unborn fetus, is recommended as supplementary reading.]

Eighteen photographs. S. F. THOMAS, M.D.
Palo Alto, Calif.

Sampling and Measurement of Airborne Daughter Products of Radon. John H. Harley. *Nucleonics* 11: 12-15, July 1953

Inhalation of the short-lived daughter products of radon may be more hazardous than inhalation of radon itself. A method is described for simple, rapid determination of radon and its daughters in the atmosphere in concentrations as low as 5×10^{-18} curies per liter. This will be of especial interest to those who manufacture and handle radon. Most radiologists will not find it of much use, but perhaps they should keep in mind some of the safe levels of radon (and thoron) in air; 1×10^{-11} c/liter of air is considered a safe recommendation.

S. F. THOMAS, M.D.
Palo Alto, Calif.

Shock, Toxemia in Radiation Lethality. Roberts Rugh, Josephine Suess, and John Scudder. *Nucleonics* 11: 52-54, August 1953.

Previous work with polyvinyl pyrrolidone (PVP) injected in mice has shown it to prevent death from traumatic shock. The polymer was also found to give protection against various toxins. Because of the similarity of some of the symptoms of impending x-irradiation death and those ameliorated with PVP, studies were made to determine its ability to afford protection against radiation. CF_1 albino adult male mice were used, since their lethality behavior under known radiation conditions is well established. PVP was given intravenously through the tail vein, intraperitoneally through the abdomen, and also subcutaneously. Both PVP-Macrose and PVP-Dextrose were employed. The injections were made following total body exposure to x-rays (700 r) from a 210-kv. constant potential therapy generator. A small group of mice were also injected with PVP-Macrose at various times prior to total body irradiation. Experiments on some 278 animals indicated that PVP, whether in combination with Macrose or with Dextrose, offers no protection for mice, whether administered before or after total-body exposure to x-rays.

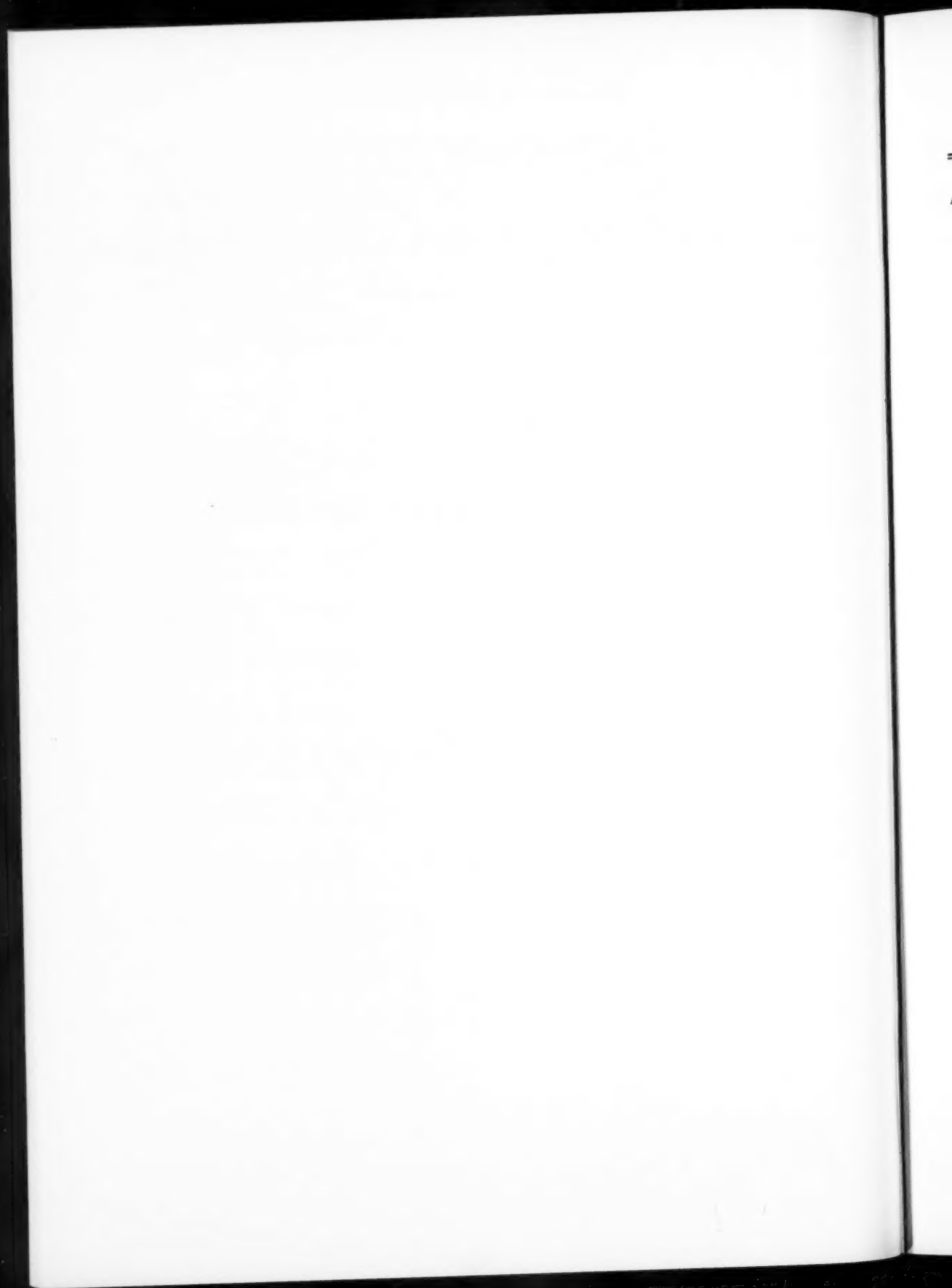
1 figure.

JOHN S. LAUGHLIN, Ph.D.
Memorial Center, New York



INDEX
TO
VOLUME 62

JANUARY—JUNE
1954



INDEX TO VOLUME 62

A

- ABDOMEN**
See also Aorta and under names of abdominal organs
—intracavitary colloidal radiogold in treatment of effusions caused by malignant neoplasms (ab), Gould A. Andrews et al, Jan., 155
—metabolism and distribution of colloidal Au¹⁹⁹ injected into serous cavities for treatment of effusions associated with malignant neoplasms (ab), Gould A. Andrews et al, Feb., 314
—pathological changes following intracavitary therapy with colloidal Au¹⁹⁹ (ab), Ralph M. Kniseley and Gould A. Andrews, Feb., 315
—radioactive gold in malignant effusions (ab), J. Walter, April, 637
—use of radioactive colloidal gold in treatment of serous effusions of neoplastic origin (ab), J. P. Storassli et al, April, 637
acute conditions
—survey roentgenograms as aid in diagnosis (ab), W. Wayne Sands, May, 773
tumors
—retroperitoneal tumors in children: roentgen diagnosis (ab), Howard L. Steinbach and Reynold F. Brown, Feb., 305
- ABORTION**
—habitual abortion: a radiographic technic to demonstrate incompetent internal os of cervix (ab), Frank E. Rubovits et al, May, 785
- ABSCISS.** See Liver
- ABSENTEEISM.** See Industry and Occupations
- ACANTHOSIS NIGRICANS**
—(ab), W. Roscher, May, 790
- ACETO, JOSEPH N., KASUGA, KASUMI, and SANDERSON, STEVENS S.:** X-ray therapy of peripheral tuberculous lymphadenitis (ab), June, 915
- ACHENBACH, W., and BOHM, A.:** Skeletal changes in parathyroid tetany (ab), May, 783
- ACHILLES TENDON.** See Tendons
- ACHONDROPLASIA**
—chondrodystrophia calcificans congenita (ab), Bedford H. Berrey and Cecil H. Kimball, March, 457
- ACID**
desoxyribonucleic. See Nucleins
hydrochloric. See Stomach, inflammation
- ACKERMAN, LAUREN V.** See **BENOIT, HECTOR W., Jr.**
See **EVANS, JOHN C.**
- ACROMEGALY**
—Troell-Juett syndrome (acromegaly complicated by thyroid toxicity and hyperostosis of skull) (ab), Sherwood Moore, April, 606
- ACTH.** See Adrenocorticotrophic Hormone
- ACTINOMYCOSIS**
—blastomycosis and actinomycosis of spine (ab), George J. Baylin and John M. Wear, March, 461
- ADAMS, ANDREW B.** See **STAUFFER, HERBERT M.**
- ADAMS, FORREST H.** See **KATZ, BEN E.**
- ADAMS, RALPH M.** See **SPECHT, NORMAN W.**
- ADAMS, RAYMOND J., and CHANDLER, FREMONT A.:** Osteitis pubis of traumatic etiology (ab), May, 784
- ADAMS, THEODORE W., WHITELEY, JAMES M., and PARROTT, MAX H.:** Intrauterine roentgenography as an aid in determining fetal age (ab), June, 907
- ADAMSON, W. E. Jr.** See **SHIELDS, W. E.**
- ADDISON'S DISEASE**
—roentgenologic observations: review of 120 cases, J. Luther Jarvis, Dalton Jenkins, Merrill C. Sosman and George W. Thorn, Jan., 16
- ADENOMA.** See Lungs, tumors; Tumors, adenoma
- ADLER, HUGO:** Phthisiogenetic considerations based on tomographic analysis of 320 consecutive cases of localized pulmonary tuberculosis in adults (ab), June, 896
- ADLERSBERG, DAVID.** See **GLAZER, ISRAEL**
- ADRENALS**
—perirenal insufflation with arteriography (ab), Frank C. Hamm and Harrison C. Harlin, June, 910
—protection of irradiated rats by parabiosis with adrenalectomized or splenectomized partners, Martin Schneider, Robert C. Wybourn, Robert Binhammer and John C. Finerty, Feb., 234
tumors
—pneumoretroperitoneum in tumors (ab), R. Haubrich and P. Thurn, April, 629
—radiographic diagnosis, James J. Joelson, Lester Persky and Frederick A. Rose, April, 488
- ADRENOCORTICAL PREPARATIONS**
—influence of adrenal and gonadal steroids on uptake of iodine by thyroid gland (ab), Walter Zingg and William F. Perry, April, 636
—treatment of radiation pneumonitis with cortisone (ab), Sanford G. Bluestein and Jacob Roemer, Jan., 159
- ADRENOCORTICOTROPIC HORMONE**
—prevention of iodism in bronchography by use of ACTH; case (ab), Felix R. Park et al, June, 894
—production of ACTH in patient undergoing gynecologic surgery or receiving pelvic irradiation (ab), Allan C. Barnes, Feb., 318
- ALBOT, GUY, OLIVIER, CLAUDE, and LIBAUDE, HENRY:** Radiomanometric examination of the biliary ducts: experience with 418 cases (ab), April, 622
- ALDERMAN, ILO M.** See **MARSTON, ROBERT Q.**
- ALEXANDER, W. STEWART:** Cerebral calcification epilepsy. Report of a case of epilepsy caused by a calcified hamartoma of the brain (ab), Jan., 125
- ALIMENTARY TRACT.** See Digestive System; Gastrointestinal Tract
- ALKALI**
—reversible metastatic calcification associated with excessive milk and alkali intake (ab), Paul Wermer et al, Jan., 141
- ALLEN, DAVID H.:** A variation of diaphyseal development which simulates the roentgen appearance of primary neoplasms of bone (ab), April, 623
Use of gastric distention as an aid to pediatric urography (ab), April, 628
- ALLEN, MAX S., DUNHAM, H. H., MONTGOMERY, CHARLES E., and SILER, EUGENE T.:** Treatment of hyperthyroidism with radioactive iodine, I¹³¹ (ab), Jan., 154
- ALLERGY**
—regional enteritis—its allergic aspects (ab), Albert H. Rowe et al, Feb., 293
- ALOE VERA**
—experimental acute radiodermatitis following beta irradiation. V. Histopathological study of mode of action of therapy with Aloe vera (ab), C. C. Lushbaugh and D. B. Hale, June, 919
- ALPER, T.** See **BOTHWELL, T. H.**
- ALTER, A. J., and LEINFELDER, P. J.:** Roentgen-ray cataract. Effects of shielding of the lens and ciliary body (ab), Jan., 158
- AMBERG, J. R.** See **KEATING, D. R.**
- AMERICAN BOARD OF RADIOLOGY**
—examinations, March, 430
- AMERICAN COLLEGE OF RADIOLOGY**
—new officers, April, 596
—Planning Guide for Radiologic Installations, American College of Radiology, March, 432
—21st annual conference of teachers of clinical radiology, Jan., 110
- AMERICAN SOCIETY OF X-RAY TECHNICIANS,** April, 596
- AMES, WENDELL R., and SCHUCK, MILLER H.:** General population roentgenographic surveys: subsequent course of persons considered to have tuberculosis (ab), April, 610
- AMICK, LAWRENCE D.:** A case of "pulmonary adenomatosis" emphasizing diagnostic considerations (ab), April, 608
- AMNIOTIC FLUID**
—transfer of sodium to amniotic fluid in normal and abnormal cases, determined by Na²⁴ tracer methods (ab), L. Woodrow Cox and T. A. Chalmers, Feb., 316
- AMPULLA OF VATER.** See Vater's Ampulla
- ANASTOMOSIS.** See Arteries; Stomach, surgery
- ANDERSEN, HOWARD A.** See **OLSEN, ARTHUR M.**
- ANDERSEN, POUL E.:** Radiological diagnosis of lipoma of the corpus callosum (ab), June, 892
- ANDERSON, AUGUSTUS E.** See **PEABODY, J. WINTHROP, Jr.**
- ANDERSON, ELDA E.:** Education and training of health physicists, Jan., 83
- ANDERSSON, TURE:** Pneumographic diagnosis of meningeomata of the falx (ab), June, 888
- ANDREWS, GOULD A., ROOT, SAM W., KERMAN, HERBERT D., and BIGELOW, ROBERT R.:** Intracavitary colloidal radiogold in the treatment of effusions caused by malignant neoplasms (ab), Jan., 155
- ROOT, SAMUEL W., and KNISELEY, RALPH M.:** Metabolism and distribution of colloidal Au¹⁹⁹ injected into serous cavities for treatment of effusions associated with malignant neoplasms (ab), Feb., 314
—See **KNISELEY, RALPH M.**
- ANDROGENS**
—influence of adrenal and gonadal steroids on uptake of iodine by thyroid gland (ab), Walter Zingg and William F. Perry, April, 636
- ANESTHESIA**
See also Bronchi, roentgenography
- ANEURYSM**
aortic
—cervical aortic knuckle which resembles an aneurysm (ab), Cecil Lewis and Lambert Rogers, Feb., 290
—dissecting aneurysms of thoracic and abdominal aorta; 6 cases, with discussion of roentgenologic findings and pathologic changes (ab), Gwilym S. Lodwick, April, 613
arteriovenous. See Aneurysm, cerebral
cerebral
—aneurysmal origin of non-fatal subarachnoid hemorrhage: angiographic survey of 53 cases (ab), Wallace B. Hamby, Jan., 126
—arteriovenous aneurysm of posterior fossa (ab), R. D. Hoare, June, 889
renal
—of accessory renal artery (ab), Harold A. Chamberlin and Michael S. Hovenanian, Jan., 148

ANGIOCARDIOGRAPHY. See Cardiovascular System; Heart
ANGIOGRAPHY. See Arteries; Blood Vessels; Brain, blood supply; Cerebellum; Roentgen Rays, apparatus

ANGIOMA. See Tumors, angioma
ANGIOPNEUMOGRAPHY. See Lungs

ANKLE

—torn Achilles tendon in roentgenogram (ab), Detlev Schoen, March, 462

ANODONTIA. See Teeth

ANSON, JOHN H. See TRUMP, JOHN G.

ANTHRACOSILICOSIS. See Pneumoconiosis

ANTIBIOTICS. See Aureomycin; Streptomycin

ANTONIE, T.: Myoma of the stomach. A review of 50 cases (ab), March, 453

AORTA

See also Aneurysm; Thrombosis

abnormalities

—cervical aortic knuckle which resembles an aneurysm (ab), Cecil Lewis and Lambert Rogers, Feb., 290

—persistent truncus arteriosus; 2 cases with right aortic arch (ab), Richard D. Rowe and Peter Vlad, June, 899

—transposition of great vessels (ab), John D. Keith et al, April, 613

calcification

—significance of calcification in ascending portion of arch, Abraham Wolkin, Jan., 101

coarctation

—accessory roentgen signs, M. M. Figley, May, 671

—of thoracic aorta: signs demonstrable by conventional roentgenography (ab), Laurence L. Robbins and Stanley M. Wyman, Feb., 289

—valvular stenosis as cause of death in surgically treated coarctation (ab), George Jacobson et al, April, 614

roentgenography

—importance of abdominal aortography in study of ischemic syndromes of lower limbs (ab), L. Possati, April, 629

—recent improvements in translumbar aortography (ab), A. Keller Doss, Jan., 149

—simple injector for aortography and intravenous angiography (ab), Frank Himann, Jr., June, 910

—technic of abdominal aortography (ab), Erik Lindgren, Jan., 149

—temporary hemiplegia from cerebral injection of Diodrast during catheter aortography; 2 cases (ab), E. Converse Peirce, 2nd, Jan., 126

—translumbar aortography as diagnostic aid in localizing arterial emboli (ab), Charles G. Livingood and Richard Patton, May, 787

—translumbar aortography in infants utilizing 70 per cent Urokon as contrast medium (ab), W. F. Melick et al, Jan., 149

rupture

—roentgenologic diagnosis of traumatic rupture of thoracic aorta (ab), Alvin C. Wyman, March, 449

AORTIC VALVE

—congenital stenosis (ab), Maurice Campbell and Ralph Kauntze, Feb., 290

APOSTOLOKIS, GEORGES, and GOUNARIS ISSIDORE G.: Contribution to the topography of the cardiac orifices and their interrelationship. Opacification of the coronary vessels (ab), May, 772

APPARATUS. See Radioactivity; Roentgen Rays, apparatus

APPENDIX

—appendiceal stones simulating ureteral calculi (ab), Thomas M. Sawyers and David D. Rosenfeld, June, 903

—urological importance of radiopaque appendiceal concretions (ab), George C. Prather and James A. Singiser, March, 465

AQUEDUCT OF SYLVII

—ventriculographic examination of aqueduct of Sylvius and fourth ventricle; 5 unusual cases (ab), Arthur E. Child et al, June, 888

ARACHNOID

—myelographic appearance of adhesive spinal arachnoiditis (ab), William B. Seaman et al, Jan., 145

ARMS

—treatment by irradiation of lymphangiosarcoma in post-mastectomy lymphedema; case (ab), Arnold J. Rawson and Joe L. Frank, Jr., Feb., 308

ARNOLD, A. BAILEY, P. HARVEY, R. A., HAAS, L. L., and LAUGHLIN, J. S.: Changes in the central nervous system following irradiation with 23-mev x-rays from the betatron, Jan., 37

ARRIETA SANCHEZ, L.: Dionosil, contrast medium for bronchography (report of our experiences) (ab), Jan., 132

ARSENIC, RADIOACTIVE. See Radioactivity

ARTERIES

See also Aneurysm; Aorta; Brain; Cardiovascular System; Extremities; Kidneys, blood supply; etc.

—arteriovenous anastomoses as seen in x-ray film (ab), E. Vogler, Jan., 148

—osteonephropathy with vascular calcification in infancy; case, Eugene P. Pendergrass and Frank P. Brooks, Feb., 227

—translumbar aortography as a diagnostic aid in localizing arterial emboli (ab), Charles G. Livingood and Richard Patton, May, 787

basilar

—persistent carotid-basilar anastomosis; 3 arteriographically demonstrated cases and 1 anatomical specimen (ab), Clinton R. Harrison and Charles Luttrell, March, 443

carotid

—angiography in diagnosis of spontaneous intracerebral hemorrhage (ab), F. Olov Löögren, June, 890

—carotid angiography with Urokon, using Chamberlain biplane stereoscopic angiographic unit; 100 cases (ab), Paul Lin et al, May, 766

—carotid cavernous fistula with signs on contralateral side; case (ab), Miguel Ramos and Lester A. Mount, Jan., 127

—cerebral phlebogram by carotid angiography in cases of central brain tumors (ab), Curt Johanson, June, 890

—collaterals between external carotid artery and vertebral artery in cases of thrombosis of internal carotid artery (ab), Hs. R. Richter, June, 889

—persistent carotid-basilar anastomosis; 3 arteriographically demonstrated cases with 1 anatomical specimen (ab), Clinton R. Harrison and Charles Luttrell, March, 443

cerebral. See also Brain, blood supply

—displacement of posterior cerebral artery in vertebral angiograms (ab), K. Decker, June, 889

coronary. See Coronary Vessels

femoral

—placentography. III. Localization of placenta by means of arteriography and auscultation (ab), Olof Norman, June, 908

hepatic

—studies on intrahepatic arterial circulation (ab), Frank Glauser, Jan., 139

innominate

—significance of buckled innominate artery (ab), Edward I. Honig et al, May, 788

pulmonary. See also Fistula, arteriovenous; Lungs, blood supply

—congenital absence of a main branch (ab), Israel Steinberg et al, April, 615

—congenital absence of pulmonary artery: its demonstration by roentgenography, Stanley M. Wyman, March, 321

—idiopathic dilatation (ab), R. H. Goetz and Maurice Nellen, March, 450

—temporary block of branch of pulmonary artery for selective angiography (ab), G. Tori and D. Petrucci, Jan., 150

—tetralogy of Fallot with unilateral pulmonary atresia: a clinically diagnosable and surgically significant variant (ab), Alexander S. Nadas et al, April, 614

renal. See also Aneurysm, renal

—angiography (ab), Marvin Harvard, June, 910

—arteriography: report of percutaneous method using femoral approach and disposable catheter (ab), E. Converse Peirce, 2nd, and William P. Ramey, Feb., 306

—résumé of experience in making of 1,500 renal angiograms (ab), Parke Smith, June, 910

roentgenography. See also other subheads under Arteries.

—catheter replacement of needle in percutaneous arteriography: a new technic (ab), Sven I. Seldinger, March, 466

—perirenal insufflation for arteriography (ab), Frank C. Hamm and Harrison C. Harlin, June, 910

subclavian

—anomalous right subclavian artery (ab), J. N. Pattinson, Feb., 290

—rib notching following subclavian artery obstruction, Bertram Levin and Leo G. Rigler, May, 660

vertebral

—angiography (ab), Olle Olsson, June, 888

—angiography in cerebellar hemangioma (ab), Olle Olsson, May, 765

—collaterals between external carotid artery and vertebral artery in cases of thrombosis of internal carotid artery (ab), Hs. R. Richter, June, 889

—displacement of posterior cerebral artery in vertebral angiograms (ab), K. Decker, June, 889

—percutaneous vertebral angiography; review of 250 cases (ab), S. E. Sjögren, June, 889

—vertebral angiography in diagnosis of acoustic nerve tumors (ab), Olle Olsson, Feb., 281

ARTERIOSCLEROSIS

—sympathectomy in chronic occlusive arterial disease (ab), W. Graham Knox and Herbert Parsons, March, 466

ARTHRITIS

See also Arthritis, Rheumatoid; Jaws

—psoriatic arthritis (ab), Eugene H. Sterne, Jr., and Benjamin Schneider, Jan., 140

—septic arthritis and osteomyelitis in infancy (ab), Seymour Heymann et al, March, 458

ARTHRITIS, RHEUMATOID

—chronic pneumopathies and rheumatism (ab), E. Martin and G. H. Fallet, June, 897

—xanthogranulomatous disease of bone with polyarthritis; 2 cases (ab), G. N. Golden and H. G. H. Richards, March, 457

ARVAY, N. See LEGER, L.

ASBOE-HANSEN, G.: Autoradiography of mast cells in experimental skin tumors of mice injected with radioactive sulfur (S^{35}) (ab), May, 795

ASH, C. L., PETERS, VERA, and DELARUE, NORMAN C.: The argument for preoperative radiation in the treatment of breast cancer (ab), March, 469

ASHER, LEONARD M. See LICHSTEIN, JACOB

ASTLEY, ROY, and CARRÉ, IVO J.: Gastro-esophageal incompetence in children, with special reference to minor degrees of partial thoracic stomach, March, 351

—OLDHAM, J. S., and PARSONS, CLIFFORD: Congenital tricuspid atresia (ab), April, 611

- ATRELECTASIS.** See Lungs, collapse
- ATLANTO-AXIAL JOINT.** See Atlas and Axis
- ATLAS AND AXIS**
- bone abnormalities in region of foramen magnum: correlation of anatomic and neurologic findings (ab), D. L. McRae, June, 802
 - non-traumatic subluxation of atlanto-axial articulation; case (ab), Felix Stein et al, March, 461
 - occipitalization of atlas (ab), D. L. McRae and A. S. Barnum May, 766
- ATOMIC BOMB**
- hematologic studies of irradiated survivors in Hiroshima, Japan (ab), Yoshimichi Yamasawa, Jan., 159
 - miscellaneous concerning nuclear explosions (ab), Carroll P. Hungate, April, 640
 - mortality in swine exposed to gamma radiation from atomic bomb source, John L. Tullis, Baldwin G. Lamson and Sidney C. Madden, March, 409
 - observations in atomic medicine. The Carman Lecture, Roger A. Harvey, April, 479
 - physical growth and development of children who survived atomic bombing of Hiroshima or Nagasaki (ab), William W. Greulich et al, June, 921
- AUREOMYCIN**
- treatment of acute radiation syndrome in dogs with Aureomycin and whole blood (ab), Frank W. Furth et al, April, 639
- AUSCULTATION.** See Placenta
- AUTORADIOGRAPHY.** See Radioactivity: Radium
- AXLER, MORTON M., and REHERMANN, ROBERT L.:** Partial eventration of the right diaphragm (ab), March, 450
- B**
- BAAB, ORREN D.** See GASTON, SAWNIE R.
- BACK, A., and WALASZEK, E. J.:** Studies with radioactive colchicine. I. Influence of tumors on the tissue distribution of radioactive colchicine in mice (ab), May, 796
- BACKACHE**
- lumbosacral junction: roentgenographic comparison of patients with and without backaches (ab), Clarence A. Splithoff, May, 783
 - lumbosacral transitional vertebrae: clinical and roentgenologic study of 400 cases of low back pain (ab), E. Hasner et al, Jan., 141
- BAER, L. J.** See GOTTLIEB, A. M.
- BAGASSOSIS**
- bagasse disease of lungs; brief review of literature and report of 2 cases (ab), Shaw McDaniel and John G. Hull, April, 610
- BAGGENSTOSS, ARCHIE H.** See MORTENSEN, JD
- BAGNALL, WILLIAM S.** See KEATS, THEODORE E.
- BAHNSON, HENRY T., SLOAN, ROBERT D., and BLALOCK, ALFRED:** Splenic-portal venography. A technique utilizing percutaneous injection of radioopaque material into the spleen (ab), Feb., 306
- BAILEY, P.** See ARNOLD, A.
- BAKAY, LOUIS:** Studies on blood-brain barrier with radioactive phosphorus. III. Embryonic development of the barrier (ab), May, 795
- and WHITE, JAMES C.: Pneumoencephalography in chromophobe adenomas of the hypophysis (ab), March, 443
- BAKER, DONALD V.** See WARTHIN, THOMAS A.
- BAKER, HARVEY W., and COLEY, BRADLEY L.:** Chordoma of lumbar vertebra (ab), Feb., 298
- BALL, R. M.** See OBRYCKI, R. F.
- BANTHINE**
- action of Bantnine on motility of small intestine studied by rapid method (ab), Juan Nasio, April, 620
 - gastric emptying time: comparative studies with placebo, Prantal and Bantnine (ab), G. Kenneth Hawkins et al, April, 617
- BARCLAY, W. R., EBERT, R. H., LeROY, G. V., MANTHEI, R. W., and ROTH, L. J.:** Distribution and excretion of radioactive Isoniazid in tuberculous patients (ab), Feb., 315
- BARIUM**
- See also Intestines, roentgenography; Intussusception
 - barium peritonitis (ab), Herbert M. Olnick and William M. Watkins, March, 455
 - simple method of ensuring correct concentration of barium contrast media (ab), Ove Mattsson, April, 631
- BARNES, ALLAN C.:** Production of ACTH in the patient undergoing gynecologic surgery or receiving pelvic irradiation (ab), Feb., 318
- See MORTON, JOSEPH L.
- BARNETT, JAMES C.** See LAAGE, HERBERT
- BARNUM, A. S.** See McRAE, D. L.
- BARONE, ARMANDO.** See MONDELLO, MARIO
- BARR, JOSEPH S., ELLISTON, WILLIAM A., MUSNICK, HENRY, DELORME, THOMAS L., HANELIN, JOSEPH, and THIBODEAU, ARTHUR A.:** Fracture of the carpal navicular (scaphoid) bone: an end-result study in military personnel (ab), May, 784
- BARRETO FRAGOSO, J. C.** See MONIZ de BETTEN-COURT, J.
- BARRETT, T. F., PECK, H., BAUER, P. K., LIBBY, R. L., and JARRETT, S. R.:** Evaluation of a thyroid panel. Practical application of scintillation counter in diagnosis of diseases of the thyroid (ab), June, 916
- BARRY, CAREY N., and ROSE, DALTON K.:** Urokon sodium 70 per cent in excretory urography (ab), April, 628
- BARRY, J. W.** See STRATEMEIER, E. H.
- BARRY, MICHAEL C., and PUGH, ALBERT E.:** Serum concentrations of radiiodine in diagnostic tracer studies (ab), June, 916
- BARTER, ROBERT H. and PARKS, JOHN:** The advantages of x-ray diagnosis in pregnancy (ab), May, 785
- BASSETT, ROBERT C., ROGERS, JAMES S., CHERRY, GLENN R., and GRUZHIT, CARL:** The effect of contrast media on the blood-brain-barrier (ab), Jan., 126
- BATES, CHARLES J.** See DAVISON, SOL
- BAUER, FRANZ K., CASSEN, BENEDICT, YOUTCHEFF, ELSE, and SHOOP, LUCILE:** Jet injection of radioisotopes. A clinical study comparing needle and jet injection of I^{131} , K^{42} , and Na^{24} (ab), Feb., 313
- See BARRETT, T. F.
 - See SPECHT, NORMAN W.
- BAUM, GEORGE L.** See REISS, JACK
- BAUMEISTER, CARL F.:** Radioiodine tracer and biopsy in the diagnosis and treatment of hyperthyroidism (ab), April, 636
- BAXTER, HAMILTON, DRUMMOND, JOHN A., STEPHENS-NEWSHAM, L. G., and RANDALL, ROBERT G.:** Reduction of mortality in swine from combined total body radiation and thermal burns by streptomycin (ab), April, 640
- BAXTER, JAMES H., and VAN WYK, JUDSON J.:** A bone disorder associated with copper deficiency. I. Gross morphological, roentgenological, and chemical observations (ab), May, 783
- BAYLIN, GEORGE J., and WEAR, JOHN M.:** Blastomycosis and actinomycosis of the spine (ab), March, 461
- See TEXTER, E. C., Jr.
- BEAL, JOHN M.** See STIRRETT, LLOYD A.
- BEARD.** See Hair
- BECK, WILLIAM C., and CHOYANY, GEORGE:** Duodenal atresia (ab), March, 455
- BELL, J. CARROLL.** See ROQUE, FRANCISCO T.
- BELL, LUTHER G., BROWN, ROBERT B., and LENHARDT, HARRY F.:** Acute pneumocholecystitis. A review and report of two cases (ab), May, 779
- BELL, RICHARD P.:** Splenic cysts with report of a case of a large unilocular cyst of rapid growth (ab), April, 623
- BENADRYL.** See Diphenhydramine
- BENCHIMOL, AARON B., and SCHLESINGER, PAUL:** Beriberi heart disease (ab), June, 899
- BENOIT, HECTOR W., Jr., and ACKERMAN, LAUREN V.:** Solitary pleural mesothelioma (ab), Feb., 286
- BERENBERG, ARNOLD L.** See FLEISCHNER, FELIX G.
- BERG, HAROLD F., CHRISTOPHERSEN, WILLIAM M., ISAACS, AVROM M., and BRYANT, J. RAY:** Localization of radioactivity in regional lymph nodes (ab), May, 795
- BERGER, I. R., and COWART, G. T.:** Renal echinococcus disease, June, 852
- GAY, BRIT B., Jr., and WHORTON, C. M.: Malignant lymphoma of the stomach, April, 527
- BERIBERI**
- beriberi heart disease (ab), Aaron B. Benchimol and Paul Schlesinger, June, 899
- BERKMAN, A. TEVFIK:** Progressive exophthalmos following thyroidectomy cured by irradiation of the cerebral centers. Case report, March, 406
- BERLAND, HARRY I.:** Roentgenologic findings in tuberculous sclerosis: bone manifestations (ab), April, 624
- BERLIN, NATHANIEL I., GOETSCH, CARL, HYDE, GRACE M., and PARSONS, ROBERT J.:** The blood volume in pregnancy as determined by P^{32} labeled red blood cells (ab), June, 917
- BERMAN, MICHAEL H., and COPELAND, HERBERT:** Filling defects of ureterogram caused by a varicose ureteral vein (ab), June, 911
- See LERMAN, FRED
- BERRY, BEDFORD H., and KIMBALL, CECIL H.:** Chondrodystrophia calcificans congenita (ab), March, 457
- BERSACK, SOLOMON R., and RIZZOLI, HUGO V.:** Malignant sympathetic neuroectodermal tumor (ab), Feb., 300
- and WHITAKER, THOMAS E., Jr.: Effect of diphenhydramine (Benadryl) on side-reactions in intravenous urography (ab), March, 463
- BERYLLIUM, RADIOACTIVE.** See Radioactivity
- BESNIER-BOECK-SCHAUMANN DISEASE.** See Sarcoidosis
- BESSLER, WALTER:** Experiences in endovesical irradiation of bladder tumors with liquid radioactive cobalt (ab), May, 794
- BESTERMAN, E. M. M., and THOMAS, G. T.:** Radiological diagnosis of rheumatic pericardial effusion (ab), Feb., 289
- BETA RAYS.** See Radiations; Radioactivity; Radium
- BETATRON**
- biological effectiveness of high speed electron beam in man, Lewis L. Haas, John S. Laughlin and Roger A. Harvey, June, 845
 - changes in central nervous system following irradiation with 23-mev x-rays from betatron, A. Arnold, P. Bailey, R. A. Harvey, L. L. Haas and J. S. Laughlin, Jan., 37
- BÉTOULIERES, P., PALEIRAC, R., and BOUDET, CH.:** Preliminary results of orbital biophysics (ab), Jan., 127
- BETTGE, S., and FRIGEL, G.:** Pathogenesis and therapy of renal osteopathy (renal rickets) (ab), April, 628

- BEUTEL, A.:** Serial radiographic observations during the early stage of acquired syphilis with follow-up x-ray films (ab), June, 906
- BHATTACHARYA, K. L., DATTA-CHAUDHURY, R., BOSE, A., and DAS-GUPTA, N. N.:** Diagnosis of breast cancer with radioactive phosphorus P^{32} (ab), May, 793
- BIGELOW, R. R.** See **ANDREWS, GOULD A.**
- See **WOODS, M. C.**
- BILE**
- bile and contrast medium reflux into pancreatic ducts (ab), Friedrich K. Kammerling, April, 622
- BILE DUCTS**
- See also **Biliary Tract**
- benign non-traumatic stricture of left intrahepatic bile duct (ab), Jerome J. Weiner and Samuel LaCorte, May, 780
- pancreatic, ductal, and vaterian neoplasms: their roentgen manifestations, Philip J. Hodes, Eugene P. Pendergrass and Norman J. Winston, Jan., 1
- radiomanometric examinations of biliary ducts; experience with 418 cases (ab), Guy Albot et al, April, 622
- ROENTGENOGRAPHY**
- cholangiography with a viscous, water-soluble contrast medium (Diodrast in methylcellulose), George Jacobson and Kenneth A. Heitmann, Feb., 241
- intravenous cholangiography (ab), Th. Hornykiewytch and H. St. Stender, June, 904
- intravenous cholangiography with Biligrafin (ab), K. Huber and H. U. Stössel, June, 905
- intravenous cholecystography with new contrast medium, "Cholografin," T. L. Orloff, D. M. Sklaroff, E. M. Cohn and J. Gershon-Cohen, June, 868
- operative and postoperative cholangiography by serial films (ab), K. E. Loose, Feb., 295
- percutaneous transhepatic cholangiography in diagnosis of obstructive jaundice (ab), A. W. Nurick et al, May, 780
- visualization of common duct during cholecystography: its significance (ab), Maurice D. Sachs, March, 455
- BILIARY TRACT**
- See also **Bile Ducts**; **Gallbladder**; etc.
- CANCER**
- diagnosis of biliary-pancreatic cancer (ab), Henry Doubilet et al, Feb., 295
- ROENTGENOGRAPHY**
- bile and contrast medium reflux into pancreatic ducts (ab), Friedrich K. Kammerling, April, 622
- BILIGRAFIN (CHOLOGRAFIN).** See **Bile Ducts**; **Gallbladder**
- BINHAMMER, ROBERT.** See **SCHNEIDER, MARTIN**
- BINKLEY, FREDERICK M., THORBURN, JACK D., STEPHENS, H. BRODIE, and GRIMES, ORVILLE F.:** Mediastinal tumors of thymic origin (ab), Feb., 308
- BIOPSY.** See **Thyroid**, **hyperthyroidism**; **Uterus**, **cancer**
- BLACK, H.** See **MELICK, W. F.**
- BLADDER**
- relationships of female urethra and bladder in urinary stress incontinence (ab), C. P. Hodgkinson, Jan., 146
- vesical physiology demonstrated by cineradiography and serial roentgenography; preliminary report, Frank Hinman, Jr., Gerald M. Miller, Eldon Nickel and Earl R. Miller, May, 713
- CALCULI**
- x-ray absorption and diffraction studies on experimental vesical calculi (ab), I. Hedenberg et al, Jan., 147
- CANCER**
- evaluation of size of neoplasms (ab), C. D. Brunkow, June, 911
- treatment of carcinoma (ab), H. P. Winsbury-White, Feb., 309
- uniformity of dosage in carcinoma (ab), Mary Douglas, April, 635
- REGURGITATION FROM**
- measurement of contrast medium reflux in retrograde pyelography by means of blood Pyridoniodine determination (ab), G. Möckel and K. Gaede, May, 786
- TUMORS**
- experiences in endovascular irradiation with liquid radioactive cobalt (ab), Walter Bessler, May, 794
- BLAKE, HU A.** See **SALVER, JOHN M.**
- BLALOCK, ALFRED.** See **BAHNSON, HENRY T.**
- BLALOCK, J.** See **OCHSNER, A.**
- BLANEY, P. J.** See **MACGREGOR, ALASTAIR G.**
- BLANSFIELD, HENRY N.** See **CLIFFTON, EUGENE E.**
- BLASTOMYCOSIS**
- blastomycosis and actinomycosis of spine (ab), George J. Baylin and John M. Wear, March, 461
- endobronchial lesions in pulmonary blastomycosis (ab), Wilson Weissel and Francis B. Landis, April, 609
- BLOCH, HARRY.** See **STEIN, FELIX**
- BLOCK, MATTHEW, JACOBSON, LEON O., and NEAL WILLIAM:** Biological studies with arsenic⁷⁶. IV. The histopathologic effect of arsenic⁷⁶ upon the hematopoietic tissues of patients with leukemia (ab), Feb., 316
- BLOCK, WALTER M.:** Chronic gastric ulcer in childhood. A critical analysis of the literature, with report of a case in an eleven-year-old boy (ab), March, 453
- BLOMFELD, G. W.:** Experience with two million volt x-ray therapy and a preliminary assessment of clinical results (ab), Feb., 310
- BLOMQUIST, OLOV A.** See **SILK, ARTHUR D.**
- BLOOD**
- See also **Erythrocytes**; **Hemopoietic System**; **Leukemia**; etc.
- effects of total-body x-irradiation on peripheral blood of monkey (ab), Earl Eldred and Bergliot Eldred, Jan., 161
- ALBUMIN.** See **Blood**, **proteins**
- FIBRIN**
- mobile floating fibrin bulla in course of hydropneumothorax (ab), G. Roche, Houpeau and M. Odabachian, Jan., 131
- IODINE**
- measurement of contrast medium reflux in retrograde pyelography by means of blood Pyridoniodine determination (ab), G. Möckel and K. Gaede, May, 786
- rate of formation of non-diffusible (organic) fraction of I¹³¹ in plasma correlated with apparent thyroid state (ab), William E. White, Feb., 314
- serum concentrations of radioiodine in diagnostic tracer studies (ab), Michael C. Barry and Albert E. Pugh, June, 916
- PLASMA**
- concomitant in vivo measurement of regional erythrocyte and plasma concentrations using I¹³¹ and P³² (ab), Allen F. Reid and Ben Wilson, March, 474
- exchange of sodium between plasma and extracellular compartments in pregnant women as determined by Na²⁴ tracer methods (ab), L. Woodrow Cox and T. A. Chalmers, Feb., 316
- PLATELETS**
- control of postirradiation hemorrhagic state by platelet transfusions (ab), M. C. Woods et al, April, 639
- PROTEINS**
- behavior of iodide¹³¹ in guinea-pigs and of I¹³¹ rabbit globulin in guinea-pigs and rabbits (ab), S. P. Masouredis et al, Jan., 156
- investigations to determine union of iron with beta globulin and its clinical significance with aid of Fe⁵⁹ (ab), F. Wuhmann and B. Jasinski, June, 917
- new technique for diagnosis of carcinoma metastatic to liver; preliminary report (ab), Lloyd A. Stirett et al, Jan., 139
- TRANSFUSIONS.** See also **Blood**, **platelets**; **Hemochromatosis**
- treatment of acute radiation syndrome in dogs with Aureomycin and whole blood (ab), Frank W. Furth et al, April, 639
- VOLUME**
- in pregnancy as determined by P³² labeled red blood cells (ab), Nathaniel I. Berlin et al, June, 917
- BLOOD-BRAIN BARRIER.** See **Hemencephalic Barrier**
- BLOOD VESSELS**
- See also **Aorta**; **Arteries**; **Brain**; **Cardiovascular System**; **Lungs**; etc.
- agenesis of lung with vascular compression of tracheobronchial tree (ab), Herbert C. Maier and Wilbur J. Gould, April, 607
- simple injector for aortography and intravenous angiography (ab), Frank Hinmann, Jr., June, 910
- BLOOM, ROBERT J.:** X-ray diagnosis of neoplasms of the gastrointestinal tract (ab), April, 616
- BLOUNT, S. GILBERT, Jr., McCORD, MALCOLM C., KOMESU, SEIICHI, and LANIER, RAYMOND R.:** Roentgen aspects of isolated valvular pulmonic stenosis, March, 337
- BLUESTEIN, SANFORD G., and ROEMER, JACOB:** The treatment of radiation pneumonitis with cortisone (ab), Jan., 159
- BLUMBERG, NATHAN.** See **GERSHON-COHEN, J.**
- BLY, PAUL.** See **HODES, PHILIP J.**
- BODY SECTION ROENTGENOGRAPHY**
- body-section radiographic equipment: modifications and accessories, W. Berkeley Zinn, March, 416
- cranial tomography in neuroradiology. Tomography of base of skull (ab), R. Bourdon, June, 891
- laminogram as aid in diagnosis of diseases of larynx (ab), LeRoy A. Schall et al, April, 606
- laminagraphy in study of cerebral sulci and cisternal spaces (ab), Fermo Mascherpa and Guido Lombardi, Jan., 124
- multifilm cassette for use in laminagraphy (ab), Waldron M. Sennott and Howard E. Worrell, May, 789
- phthysiological considerations based on tomographic analysis of 320 consecutive cases of localized pulmonary tuberculosis in adults (ab), Hugo Adler, June, 896
- pneumostratigraphic study of stomach (ab), Mario Mondello and Armando Barone, April, 616
- principles of vertebral tomography (ab), Ingemar Bokström, Jan., 142
- qualitative comparison between standard type of examination and tomography for certain intraosseous structural changes (ab), Folke Knutson, Jan., 143
- simple determination of tomographic levels, Milton Elkin, Alice Ettinger and Robert I. Phillips, Feb., 198
- tomographic study of pulmonary veins in mitral disease (ab), J. Moniz de Bettencourt et al, April, 615
- BOECK'S SARCOID.** See **Sarcoidosis**
- BÖHM, A.** See **ACHENBACH, W.**
- BÖHM, F.:** The problem of surface anesthesia of the upper air passages (ab), June, 894
- BOGSCH, ALBERT:** Permanent deposition of iodine contrast medium in the wall of the stomach (ab), Jan., 137
- BOKSTRÖM, INGEMAR:** Principles of vertebral tomography (ab), Jan., 142
- BOLAND, S. J.:** Radiological determination of placental site (ab), May, 786
- BOLER, T. D.** See **MELICK, W. F.**
- BOLKER, NORMAN:** Nitrogen balance in malignant disease (ab), March, 467

BONES

—See also Cranium; Spine; Wrist; under names of bones
—effect of 2,000 r local x-irradiation on metabolism and alkaline phosphatase activity of rat bone (ab), S. H. Cohn and J. K. Gong, Feb., 319

—investigation of radium deposition in human skeleton by gross and detailed autoradiography (ab), William B. Loney and Lois A. Woodruff, May, 797

—roentgen manifestations of unrecognized skeletal trauma in infants (ab), Frederic N. Silverman, March, 456

atrophy

—comparative study of reaction to injury. II. Hypervitaminosis D in frog with special reference to lime sacs (ab), Hans G. Schlumberger and Donald H. Burk, June, 906

—experimental study of first radiologic manifestations of osteoporosis (ab), Giorgio Fusi, Jan., 140

—osteoporosis as early symptom of osteochondrosis deformans coxae juvenilis (Perthes) (ab), F. Witz, Feb., 299

cancer

—observations on radiotherapy of bony metastases of breast carcinoma (ab), K. Overhof, Jan., 151

—thyroid carcinoma: visualization of distant osseous metastasis by scintiscanner; observations during I¹³¹ therapy (ab), Norman W. Specht et al, April, 636

—variation of diaphyseal development which simulates roentgen appearance of primary neoplasms (ab), David H. Allen, April, 623

diseases. See also Leontiasis Ossium; Osteitis; Osteoarthropathy; Osteochondritis

—fungus infection, Robert J. Reeves and Robert Pedersen, Jan., 55

—Looser zones (Umbauzonen) of multiple localization and atypical course (ab), Neopolo Maracini, May, 782

—mechanism of production of pseudofractures in osteomalacia (Milkman's syndrome), Howard L. Steinbach, Felix O. Kolb and Rutherford Gillilan, March, 388

—simultaneous occurrence of fibrous dysplasia (Jaffe-Lichtenstein) and extraosseous fibromyxomata (ab), K. Braunwarth, March, 458

fractures. See Fractures

fragility. See Osteosclerosis fragilis

growth

—evaluation of skeletal age method of estimating children's development. I. Systematic errors in assessment of roentgenograms (ab), Donald Mainland, May, 781

—radiological evidence of growth in children with acute leukemia treated with folic acid antagonists, Harry A. Waisman and Roger A. Harvey, Jan., 61

—significance of growth in roentgenological skeletal changes in early congenital syphilis (ab), Arne Engset et al, Feb., 296

—variation of diaphyseal development which simulates roentgen appearance of primary neoplasms of bone (ab), David H. Allen, April, 623

marrow

—evaluation in patients with chronic leukemia treated by splenic x-irradiation; preliminary report (ab), F. W. Gunz, June, 921

—hypoplasia of marrow associated with radioactive colloidal gold therapy (ab), Thomas W. Botsford et al, Jan., 155

osteomyelitis. See Osteomyelitis

pathology

—bone disorder associated with copper deficiency. I. Gross morphological, roentgenological, and chemical observations (ab), James H. Baxter and Judson J. Van Wyk, May, 783

—changes in neurofibromatosis (Recklinghausen) (ab), G. Miller, April, 625

—generalized hyperostosis and pachyderma (ab), Zdeněk Mařatka and Adolf Štředa, March, 457

—infantile cortical hyperostosis (Caffey-Smyth syndrome) case in Negro infant (ab), Melvin E. Jenkins and Roland B. Scott, March, 458

—periosteopathy of mother-of-pearl workers (ab), Antonio Runco and Roberto Bossi, May, 781

—reversible metastatic calcification associated with excessive milk and alkali intake (ab), Paul Werner et al, Jan., 141

—roentgenologic findings in tuberous sclerosis: bone manifestations (ab), Harry I. Berland, April, 624

—skeletal changes in parathyroid tetany (ab), W. Achenbach and A. Böhm, May, 783

—vitamin D poisoning with metastatic calcification; report of case and review of mechanism of intoxication (ab), Charles W. Wilson et al, Jan., 141

syphilis

—contribution to congenital syphilis (ab), Z. Gregor and M. Kováčová, March, 460

—serial radiographic observations during early stage of acquired syphilis with follow-up x-ray films (ab), A. Beutel, June, 906

—significance of growth in roentgenological skeletal changes in early congenital syphilis (ab), Arne Engset et al, Feb., 296

tumors

—calcifying enchondroma of long bones (ab), W. Laurence and E. L. Franklin, March, 462

—eosinophilic granuloma with roentgenographic demonstration of a sequestrum; case (ab), Richard G. Wilson et al, April, 623

—histiocytosis X. Integration of eosinophilic granuloma of bone, "Letterer-Siwe disease," and "Schüller-Christian disease" as related manifestations of single nosologic entity (ab), Louis Lichtenstein, May, 782

—malignant sympathetic neuroectodermal tumor (ab), Solomon R. Bersack and Hugo V. Rizzoli, Feb., 300

—neurilemmoma (ab), H. Morus Jones, May, 783

—place of external irradiation in treatment of osteogenic sarcoma (ab), R. C. Tudway, Jan., 153

BONSE, G., and KARG, R.: X-ray findings in Kaposi's angiomas (sarcoma idiopathicum haemorrhagicum multiplex) (ab), Feb., 307

BONTE, F. J. See STORAASLI, J. P.

BOOK REVIEWS

Behrens, Charles F., editor. Atomic Medicine, Jan., 116

Brailsford, James F. The Radiology of Bones and Joints. An Introduction to the Study of Tumors and Other Diseases of Bone, Jan., 113

Brocq, P., Moulouquet-Dolérès, P., Marciot, R., and Hartmann, H. Atlas d'hystérogaphie, Jan., 114

Casagrande, Peter A. Fundamentals of Clinical Orthopedics, March, 433

de Lorimier, Alfred A., Moehring, Henry G., and Hannan, John R. Clinical Roentgenology. Vol. I. Developmental and Systemic Conditions and Local Lesions in the Extremities, April, 597

Gardella, Giovanni, and Sanguirico, Giovanni. Le gastriti (studio radiologico), Jan., 115

Gregoir, W. L'Urokyographie et la radiomanométrie urinaire, Jan., 113

Haddow, A., editor. Biological Hazards of Atomic Energy, April, 598

Johns, Harold E. The Physics of Radiation Therapy, April, 598

Karel, Frits, and Frodl, Otto. Bronchiaal-boom, Segmenten en Bloedvaten van de Long met hun Variaties, Jan., 114

Lisch, G., and Nerli, A. Le ossificazioni e le calcificazioni pachimeningee retrosellari, Jan., 115

McLaren, J. W., editor. Modern Trends in Diagnostic Radiology, March, 432

Planning Guide for Radiologic Installations, American College of Radiology, March, 432

di Rienzo, S., Mosca, L. G., and Zorrilla, J. I. Tratado de Radiología, June, 880

Rigler, Leo G. The Chest. A Handbook of Roentgen Diagnosis, April, 597

Schinz, H. R., Baensch, W. E., Friedl, E., and Uehlinger, E. Roentgen-Diagnostics. Vol. III. Thorax (English trans.), Jan., 112

Sears, Thad P. The Physician in Atomic Defense. Atomic Principles, Biologic Reaction and Organization for Medical Defense, March, 432

Segers, Marcel, and Brombart, Marcel. L'oesophage en cardiologie. Etude radiologique de l'oesophage dans les cardiopathies congénitales et acquises, May, 755

Spear, F. G. Radiation and Living Cells, March, 433

Symposium on Chromosome Breakage, Jan., 116

Teschendorf, W. Die Teleröntgentherapie, June, 879

Wachsmann, F., and Barth, G. Die Bewegungsbestrahlung, May, 755

BOOKS RECEIVED (not reviewed)

Beckerley, James G., editor. Annual Review of Nuclear Science, Feb., 273

Blaha, H. Schichtbilder von Bronchialveränderungen bei der Lungentuberkulose, May, 755

Bureau, Jacques. L'étude radiologique des voies séminales, normales et pathologiques, Feb., 273

Buffard, P., and Crozet, L. La pratique du radiodiagnostic clinique, May, 755

Castellano, Francesco, and Ruggiero, Giovanni. Meningiomas of the Posterior Fossa, Jan., 112

Chadwick, James. Radioactivity and Radioactive Substances, Jan., 112

Chiray, M., Gutmann, R. A., and Sénéque, J., editors. Confrontations Radio-Anatomo-Cliniques. Fasc. V, May, 755

Clemmensen, Joha., editor. Cancer of the Lung (Endemiology). A Symposium, June, 879

Davidson, J. N. The Biochemistry of the Nucleic Acids, April, 597

Donaldson, Samuel Wright. The Roentgenologist in Court, April, 597

Edwards, Jesse E., et al. An Atlas of Congenital Anomalies of the Heart and Great Vessels, May, 754

Encyclopédie Electro-Radiologique: Radiodiagnostic, Tome IV. Tube Digestif-Foie-Rate-Pancreas, June, 879

Ernest, Wilhelm. Strahlenschutz und sonstiger Arbeitsschutz bei der medizinischen Anwendung von Röntgenstrahlen, Jan., 112

Exner, Gerhard. Die Halswirbelsäule. Pathologie und Klinik, May, 755

Fifteenth Semiannual Report of the Atomic Energy Commission, January 1954, April, 597

Fishbein, Morris, editor. Medical Progress, 1954, April, 597

Greenstein, Jesse P., and Haddow, Alexander, editors. Advances in Cancer Research, June, 879

Hasselwander, A. Die objektive Stereoskopie an Röntgenbildern, April, 597

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Herdner, Robert. Traité technique de tomographie osseuse, May, 755

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BOOKS RECEIVED (not reviewed)—cont.

- Jirout, Jan. Obecná Neuroradiologie, Jan., 112
- Köhler's Grenzen des Normalen und Anfänge des Pathologischen im Röntgenbilde des Skelettes, revised by Dr. E. A. Zimmer, Jan., 112
- Kováts, F., Jr., and Zsebök, Z. Röntgenanatomische Grundlagen der Lungenuntersuchung, May, 755
- Leupold, Ernst. Die Bedeutung des Blutchemismus, Besonders in Beziehung zu Tumorbildung und Tumorbau, April, 597
- Magee, John L., Kamen, Martin D., and Platzman, Robert L. Physical and Chemical Aspects of Basic Mechanisms in Radiobiology, June, 879
- Moore, George E. Diagnosis and Localization of Brain Tumors: A Clinical and Experimental Study Employing Fluorescent and Radioactive Tracer Methods, Feb., 273
- Papanicolaou, George N. Atlas of Exfoliative Cytology, March, 431
- De Reus, H. D. Arterio-en Aortographie bij Arteriële Circulatiestoornissen der Extremiteten, Jan., 112
- Rhinehart, Darmon A. Roentgenographic Technique. A Manual for Physicians, Students, and Technicians, May, 754
- Selected Papers from the Institute of Cancer Research (Royal Cancer Hospital) and from the Royal Cancer Hospital 1950-1951, March, 431
- Selman, Joseph. Fundamentals of X-Ray and Radium Physics, June, 879
- Transactions of the American Ophthalmological Society Eighty-ninth Annual Meeting, Hot Springs, Virginia, 1953, June, 879
- BORNHOLM'S DISEASE.** See Myositis
- BOSE, A.** See BHATTACHARYA, K. L.
- BOSEN, WILLIAM R., and TYSON, M. DAWSON:** Spontaneous perforation of a benign gastric ulcer into the transverse colon. Report of a case (ab), March, 454
- BOSSI, ROBERTO.** See RUNCO, ANTONIO
- BOTHWELL, T. H., van DOORN-WITTKAMPF, H. van W., DU PREZ, M. L., and ALPER, T.:** The absorption of iron: radioiron studies in idiopathic hemochromatosis, malnutritional cytosiderosis, and transfusional hemosiderosis (ab), April, 638
- BOTSFORD, THOMAS W., WHEELER, H. BROWNELL, NEWTON, ROBERT A., and JAQUES, WILLIAM E.:** Hypoplasia of bone marrow associated with radioactive colloidal gold therapy (ab), Jan., 135
- BOUCOT, KATHARINE R.** See WEISS, WILLIAM
- BOUDET, CH.** See BÉTOULIÈRES, P.
- BOURDON, R.:** Cranial tomography in neuroradiology; tomography of the base of the skull (ab), June, 891
- BOYCE, WILLIAM H., DETER, JOHN H., and VEST, SAMUEL A.:** A new technique of venography of the lower extremities with Urokon (ab), Feb., 306
- BOYD, F. C.** See GREEN, D. T.
- BOYD, GLADYS:** Intralobar pulmonary sequestration (ab), June, 890
- BRADY, JOHN M.** See LAAGE, HERBERT
- BRAIN**
- See also Aqueduct of Sylvius; Cerebellum; Corpus Callosum; Meninges; Pituitary Body; etc.
- casts of cerebral ventricles (ab), R. J. Last and D. H. Tompsett, March, 442
- cerebellar medulloblastoma: treatment by irradiation of whole central nervous system (ab), Edith Paterson and R. F. Farr, Feb., 307
- changes in central nervous system following irradiation with 23-mev x-rays from betatron, A. Arnold, P. Bailey, R. A. Harvey, L. L. Haas and J. S. Laughlin, Jan., 37
- temporary hemiplegia from cerebral injection of Diodrast during catheter aortography; 2 cases (ab), E. Converse Peirce, 2nd, Jan., 126
- upward displacement of posterior part of third ventricle: a method for its evaluation (ab), Giovanni Ruggiero and Francesco Castellano, March, 442
- ventricular displacement and electroencephalographic focus in multiple sclerosis (ab), P. A. Lindstrom, May, 764
- abnormalities**
- agenesis of corpus callosum with concomitant malformations, including atresia of foramen of Luschka and Magendie (ab), Eugene F. Van Epps, May, 765
- blood supply. See also Aneurysm, cerebral; Brain, tumors
- angiographic studies in problem of brain revascularization (ab), V. Gvozdanović and D. Riessner, June, 890
- angiography following cerebral vascular accidents (ab), P. Miksa, April, 606
- cerebral angiography: fundamentals in anatomy and physiology (ab), Philip J. Hodes et al, May, 764
- directly opacifying injections into venous system of head (ab), H. Fischgold et al, June, 890
- effect of contrast media on blood-brain barrier (ab), Robert C. Bassett et al, Jan., 126
- homemade inexpensive manual rapid cassette changer for angiocardiology and cerebral angiography, Kenneth W. Taber, May, 728
- inexpensive semi-automatic serialographic apparatus for angiography (ab), Gregory B. Nichols, March, 444
- percutaneous vertebral angiography; review of 250 cases (ab), S. E. Sjögren, June, 889
- vertebral angiography (ab), Olle Olsson, June, 888
- calcification**
- cerebral calcification epilepsy; case of epilepsy caused by calcified hamartoma of brain (ab), W. Stewart Alexander, Jan., 125
- intracranial calcification as late result of tuberculous meningitis following treatment by streptomycin (ab), R. Garsche, Feb., 282
- cysticercosis**
- ventriculographic changes in cysticercosis (ab), D. Govinda Reddy and B. Ramamurthy, May, 764
- cysts**
- colloid cysts of third ventricle; 7 cases (ab), James L. Poppen et al, March, 442
- hemorrhage**
- carotid angiography in diagnosis of spontaneous intracerebral hemorrhage (ab), F. Olov Löfgren, June, 890
- spontaneous intracranial hemorrhage in children; 8 cases in children of 15 years of age or younger (ab), Wallace P. Ritchie and Gerald Haines, Feb., 282
- necrosis**
- following x-ray therapy (ab), Eldon L. Foltz et al, May, 796
- roentgenography.** See also other subheads under Brain
- cisternography (ab), S. Masay and A. Grégoire, June, 890
- laminagraphy in study of cerebral sulci and cisternal spaces (ab), Fermo Mascherpa and Guido Lombardi, Jan., 124
- pneumoencephalography, with special reference to demonstration of basal cisterns (ab), P. W. E. Sheldon et al, Feb., 281
- roentgenologic recognition of habenular calcification as distinct from calcification in pineal body: its application in cerebral localization (ab), Herbert M. Stauffer et al, May, 765
- ventriculographic examination of aqueduct of Sylvius and fourth ventricle; 5 unusual cases (ab), Arthur E. Childe et al, June, 888
- ventriculography with small amounts of air (ab), B. G. Ziedses des Plantes, June, 888
- tumors**
- cerebral calcification epilepsy; case caused by calcified hamartoma (ab), W. Stewart Alexander, Jan., 125
- cerebral phlebogram by carotid angiography in cases of central brain tumors (ab), Curt Johanson, June, 890
- directed beam therapy. II. Multiple small field irradiation of pituitary gland, pituitary tumors and other intracranial lesions (ab), B. V. A. Low-Beer et al, April, 631
- displacement of posterior cerebral artery in vertebral angiograms (ab), K. Decker, June, 889
- encephalography in cases of intracranial tumor (ab), Bengt Falk, June, 888
- experiences in localization by means of diiodo¹³¹ fluorescein (ab), S. E. Sjögren, June, 891
- localization of intracranial neoplasms with radioactive isotopes, William B. Seaman, Michel M. Ter-Pogossian and Henry G. Schwartz, Jan., 30
- multiple-counter system for isotope encephalometry (ab), Douglas A. Kohl, June, 916
- of posterior portion of third ventricle (ab), Robert W. Rand and Lloyd J. Lemmen, Jan., 124
- phlebography in brain stem tumors (ab), Hs. R. Richter, June, 890
- radiologic aspects of pontine gliomata (ab), David Sutton, June, 892
- relative accuracy of electroencephalography, air studies and angiography in a series of 200 mass lesions (ab), F. A. Martin et al, May, 764
- roentgen treatment of gliomata (ab), Martin Lindgren, June, 913
- symptoms and signs referable to basal ganglia in brain tumor (ab), Daniel Sciarra and Bertram E. Sprockin, Feb., 281
- treatment of cerebral gliomas with 24-million-volt x-rays (ab), D. A. Layne et al, Jan., 151
- BRAUDO, J. L.** See HEYMANN, SEYMOUR
- BRAUER, R. W.** See BRIGGS, F. N.
- v. BRAUNBEHRENS, HANS:** Radiation therapy of Paget's disease of the breast (ab), June, 915
- BRAUNWARTH, K.:** Simultaneous occurrence of fibrous dysplasia (Jaffe-Lichtenstein) and extra-osseous fibromyxoma (ab), March, 458
- BREAST**
- cancer**
- argument for preoperative radiation in treatment (ab), C. L. Ash et al, March, 469
- carcinoma, with particular reference to preoperative radiation (ab), M. Vera Peters, April, 633
- diagnosis with radioactive phosphorus P₃₂ (ab), K. L. Bhattacharya et al, May, 793
- observations on radiotherapy of bony metastases of breast carcinoma (ab), K. Overhof, Jan., 151
- radiotherapy, with particular reference to value of preoperative irradiation as supplement to radical mastectomy: analysis of 1,418 new cases (ab), Sigvard Kaas, Feb., 307
- roentgenographic diagnosis of calcification in carcinoma (ab), J. Gershon-Cohen et al, April, 615
- treatment by irradiation of lymphangiosarcoma in post-mastectomy lymphedema; case (ab), Arnold J. Rawson and Joe L. Frank, Jr., Feb., 308
- diseases**
- radiation therapy of Paget's disease (ab), Hans v. Braunbehrens, June, 915
- BREGAT, P.** See FISCHGOLD, H.

- BREMNER, A. E., and NELIGAN, G. A.:** Benign form of acute osteitis of the spine in young children (ab), Feb., 297
—See **WARRICK, C. E.**
- BRETTON, A.:** Prolonged pulmonary forms of Bornholm's disease (ab), Jan., 128
- BRICKLEY, BARBARA A.** See **BURWELL, E. LANGDON**
- BRIDGMAN, CHARLES F.** See **POLLACK, HERBERT C.**
- BRIGGS, F. N., BRAUER, R. W., TAUBOG, A., and CHAIKOFF, I. L.:** Metabolism of 131 I-labeled thyroxine—studies with isolated, perfused rat liver (ab), Jan., 157
- BRIGGS, JOHN D., and NEALE, RODERICK M.:** Renocolic fistula. Report of a case (ab), Feb., 305
- BRILL-SYMMERS DISEASE.** See **Lymph Nodes**
- BRINDLEY, G. V., Jr.:** Bronchogenic carcinoma simulating benign pulmonary disease (ab), March, 445
- BRISTOL, LEONARD J.** See **STEENKEN, WILLIAM, Jr.**
- BRODIE, ALLAN G.** See **SARNAT, BERNARD G.**
- BRONCHI**
—See also **Bronchiectasis**
—agenesis of lung with vascular compression of tracheobronchial tree (ab), Herbert C. Maier and Wilbur J. Gould, April, 607
—deformity of bronchi (ab), Yuriy Holyi and Robert Poch, March, 445
—endobronchial lesions in pulmonary blastomycosis (ab), Wilson Weisel and Francis B. Landis, April, 609
—cancer. See also **Lungs, cancer**
—association of tuberculosis and primary bronchogenic cancers (ab), J. Delarue et al, March, 446
—bronchogenic carcinoma in San Diego County: relation of mortality rates to findings in mass chest x-ray survey (ab), A. S. Churchill, Jan., 130
—bronchogenic carcinoma simulating benign pulmonary disease (ab), G. V. Brindley, Jr., March, 445
—carcinoma of middle-lobe bronchus (ab), G. Brian Locke, May, 769
—contribution to early diagnosis of carcinoma by simple contrast demonstration of bronchial tree (ab), E. Liese et al, June, 895
—early recognition and treatment of bronchogenic carcinoma (ab), Jack Reiss et al, March, 445
—intrathoracic irradiation of hilum after resection for bronchial carcinoma; preliminary report (ab), W. E. J. Schneiderzik, Jan., 151
—Pancoast syndrome due to bronchogenic carcinoma: successful surgical removal and postoperative irradiation; case (ab), William M. Chardack and James D. MacCallum, Feb., 308
—roentgenologic and clinical aspects of lung resection (operability and postoperative course) (ab), H. J. Gombert et al, June, 895
—technic of simulated rotation therapy for carcinoma (ab), I. Churchill-Davidson, April, 634
- cysts**
—mucocoele, congenital bronchiectasis, and bronchiogenic cyst (ab), Beatty H. Ramsay and Francis X. Byron, April, 608
- obstruction**
—mucocoele of lung due to congenital obstruction of segmental bronchus; case. Relationship to congenital cystic disease of lung and to congenital bronchiectasis (ab), Beatty H. Ramsay, May, 767
—with lobar atelectasis and emphysema in cystic fibrosis of pancreas (ab), Paul A. di Sant'Agnes, May, 771
- roentgenography.** See also **Bronchi, cancer**
—bronchography with Joduron B (ab), Milan Svoboda, March, 444
—bronchography with rapidly eliminated compound "Dionosil" (ab), Christopher Cummins and C. P. Silver, June, 894
—changes in bronchi in silicosis and silicotuberculosis (ab), G. Worth and W. Heinz, Jan., 128
—clinical experience with water-soluble bronchography compounds (ab), Mordant E. Peck et al, Jan., 131
—clinical findings and anatomical changes in lungs following bronchography with Perabrodil BR (viscosity 60 per cent) (ab), H. W. Weber and B. Lohr, June, 894
—could a damaged liver be cause of lethal Pantocain intoxication (during bronchography)? (ab), H. Fietz, Jan., 132
—Dionosil, contrast medium for bronchography. Report of our experiences (ab), L. Arrieta Sánchez, Jan., 132
—further empirical and experimental studies with Joduron bronchography (ab), H. U. Zollinger and F. K. Fischer, June, 893
—prevention of iodism in bronchography by use of ACTH; case (ab), Felix R. Park et al, June, 894
—problem of surface anesthesia of upper air passages (ab), F. Böhm, June, 894
—technic of bronchography in children (ab), Paul Ch. Schmid, Feb., 284
- tuberculosis**
—tuberculous bronchitis and bronchiectasis (ab), G. Simon, May, 768
- tumors**
—bronchial and pulmonary hamartochondromas (ab), Paul Santy et al, Feb., 286
—osteochondroma (ab), Rudolph Nissen et al, March, 448
- BRONCHIECTASIS**
—Kartagener's triad; 2 cases, T. A. Groas, March, 347
—mucocoele, congenital bronchiectasis, and bronchiogenic cyst (ab), Beatty H. Ramsay and Francis X. Byron, April, 608
—mucocoele of lung due to congenital obstruction of segmental bronchus; case. Relationship to congenital cystic disease of lung and to congenital bronchiectasis (ab), Beatty H. Ramsay, May, 767
—tuberculous bronchitis and bronchiectasis (ab), G. Simon, May, 768
- BRONCHITIS.** See **Bronchi**
- BROOKS, FRANK P.** See **PENDERGRASS, EUGENE P.**
- BROWN, R. F.** See **LOW-BEER, B. V. A.**
- See **STEINBACH, HOWARD L.**
- BROWN, ROBERT B.** See **BELL, LUTHER G.**
- BROWN, W. M. COURT, MAHLER, R. F., ET AL:** Discussion on the radiation syndrome (ab), Feb., 317
- BROWN, WEBSTER H.** See **DAVIDSON, CHARLES N.**
- BRUCER, MARSHALL:** Encouraging and discouraging research with therapeutic radioisotopes (ab), April, 635
—Teletherapy design problems, Jan., 91
- BRUNKOW, C. D.:** Evaluation of size of bladder neoplasms (ab), June, 911
- BRUNST, V. V., and FIGGE, FRANK H. J.:** Influence of roentgen rays upon the development of the mouse by local irradiation of some parts of the body (ab), Feb., 319
- BRUYN, HENRY B.** See **STEINBACH, HOWARD L.**
- BRYAN, W. RAY, LORENZ, EGON, and CALNAN, DOROTHY:** Protecting action of citrate on the agent of chicken Tumor I (Rous sarcoma virus) during roentgen radiation in vitro (ab), May, 798
- BRYANT, J. RAY.** See **BERG, HAROLD F.**
- BUECHNER, HOWARD A.** See **PEABODY, J. WINTHROP, Jr.**
- BUETTI, C.:** Aseptic necrosis of the capitulum humeri (ab), June, 907
—Roentgen diagnosis of rare malformations of the cervical spine (ab), March, 460
- BUHAC, I.** See **KÖRBLER, J.**
- BULL, J. W. D.:** Spinal meningiomas and neurofibromas (ab), June, 912
- BULLA.** See **Blood, fibrin**
- BULLINGTON, R. H.** See **SNARELY, J. R.**
- BURCH, G. E.** See **LOVE, WILLIAM D.**
- See **THREFOOT, S. A.**
- BURGOS, RAÚL.** See **IRIMINI, RICARDO**
- BURK, DONALD H.** See **SCHLUMBERGER, HANS G.**
- BURKELL, C. C.** See **WATSON, T. A.**
- BURNS**
—reduction of mortality in swine from combined total body radiation and thermal burns by streptomycin (ab), Hamilton Baxter et al, April, 640
- BURNS, EDGAR:** Clinical diagnosis of tumors of adult renal parenchyma (ab), June, 911
- BURSA**
—lesions producing bursitis-like symptoms: importance of radiographic study before treatment of bursitis (ab), John D. Osmond, Jr., Feb., 299
- BURWELL, E. LANGDON, BRICKLEY, BARBARA A., and FINCH, CLEMENT A.:** Erythrocyte life span in small animals. Comparison of two methods employing radioiron (ab), Jan., 158
- BUSCHKE, F.:** Fourteen years of supravoltage therapy in the Swedish Hospital, Seattle, U. S. A. (ab), June, 913
- and **CANTRIL, S. T.:** Results of supravoltage roentgenotherapy of esophageal carcinoma (ab), April, 633
- BYRNE, JOHN E., and MELICK, WILLIAM F.:** Clinical experiences with a new medium (70 per cent Urokon-Sodium) in intravenous urography (ab), June, 909
- BYRON, FRANCIS X.** See **RAMSAY, BEATTY H.**

C

- CACCIARI, A., and FRASSINETI, A.:** Evaluation of the radiologic visualization of the spleno-portal vein (splenoportography) (ab), April, 630
- CACERES, EDUARDO.** See **MENDELSON, MORTIMER L.**
- CADAVERS**
—National Bureau of Standards Handbook 56, Safe Handling of Cadavers Containing Isotopes, March, 430
—postmortem roentgenography with particular emphasis upon the lung, Roy R. Greening and Eugene P. Pendergrass, May, 720
- CAFFEY-SMYTH SYNDROME.** See **Bones, pathology**
- CALCANEUM**
—fractures, with atlas illustrating various types (ab), C. K. Warrick and A. E. Bremner, Jan., 145
- CALCIFICATION**
—See also **Aorta; Arteries; Breast, cancer; Kidneys; Pineal Gland; Soft Tissue; Spine, intervertebral disks; Stomach, tumors; etc.**
—reversible metastatic calcification associated with excessive milk and alkali intake (ab), Paul Wermer et al, Jan., 141
—vitamin D poisoning with metastatic calcification; report of case and review of mechanism of intoxication (ab), Charles W. Wilson et al, Jan., 141
- CALCIUM AND CALCIUM COMPOUNDS**
—comparative study of reaction to injury. II. Hypervitaminosis D in frog with special reference to lime sacs (ab), Hans G. Schlumberger and Donald H. Burk, June, 906
- CALCULI.** See **Gallbladder; Ureters; Urethra; etc.**
- CALDERIN GOMEZ, ALBERTO:** A case of true pancreatic cyst in early infancy (ab), Feb., 296

- Calendine, George W., Jr.** See **Morton, Joseph L.**
- Calnan, Dorothy.** See **Bryan, W. Ray**
- Campbell, Darrell A.** See **Gabriel, Louis T.**
- Campbell, L. S.** See **Hamsa, W. R.**
- Campbell, Maurice, and Kauntze, Ralph:** Congenital aortic valvular stenosis (ab), Feb., 290
- Campbell, Robert T.:** Intestinal obstruction with congenital absence of the left diaphragm (ab), May, 777
- Campos, Joseph.** See **Knaus, William E.**
- Campoy, Francisco.** See **Hodes, Philip J.**
- Cancer**
See also under names of organs; Tumors, experimental
—Eighth Annual Cancer Symposium, M. D. Anderson Hospital, June, 878
—high-energy electrons for treatment of extensive superficial malignant lesions (ab), John G. Trump et al, Feb., 310
—International Cancer Congress (Sixth), Jan., 111
—metabolism and distribution of colloidal Au¹⁹⁸ injected into serous cavities for treatment of effusions associated with malignant neoplasms (ab), Gould A. Andrews et al, Feb., 314
—nitrogen balance in malignant disease (ab), Norman Bolker, March, 467
metastases. See also Bones, cancer; Lungs, cancer; Lymph Nodes, cancer; Radioactivity, radiogold
—new technic for diagnosis of carcinoma metastatic to liver; preliminary report (ab), Lloyd A. Stirrett et al, Jan., 139
radiotherapy. See also Radioactivity, radiogold; under organs and regions
—method of tumor localization and field positioning in radiotherapy, H. D. Jamieson, Feb., 195
—radioreistance and development of resistance of malignant tumors (ab), Gerhard Schubert, Jan., 159
—selection of far advanced cancer patient for roentgen therapy (ab), James O'Donoghue, April, 635
- Cannon, Jack A.** See **Shore, Samuel**
- Carter, Harry Y.** See **Smith, Willie W.**
- Cantril, S. T.** See **Buschke, F.**
- Capitulum humeri.** See **Humerus**
- Carra, D. J., Jr.** See **Heacock, C. H.**
- Carbohydrates**
—experimental acute radiodermatitis following beta irradiation. IV. Changes in respiration and glycolysis (carbohydrate metabolism) (ab), C. C. Lushbaugh and D. B. Hale, June, 919
- Carbon tetrachloride**
—nature and genesis of pulmonary alterations in carbon tetrachloride poisoning (ab), William Umiker and John Pearce, Jan., 131
- Carbonated beverages**
—use of gastric distention as an aid to pediatric urography (ab), David H. Allen, April, 628
- Cardia: Cardiospasm.** See **Stomach**
- Cardiovascular system**
See also Aorta; Heart; etc.
—mortality of persons with photofluorograms suggestive of disease (ab), George W. Comstock, April, 611
—transposition of great vessels (ab), John D. Keith et al, April, 613
roentgenography
—cineradiographic studies of cardiovascular disease (ab), Robert F. Rushmer et al, March, 448
—contrast media for kidneys, heart and vessels, and their toxicity (ab), Carl Sandström, Feb., 303
—homemade inexpensive manual rapid cassette changer for angiocardiology and cerebral angiography, Kenneth W. Taber, May, 728
—method of angiocardiology (ab), Ian M. Hill, Jan., 134
—role of exposure rate in angiocardiology (ab), Carl Wegelius and John Lind, Jan., 134
- Carlson, J. Gordon, Harrington, Nyra, G., and Gauden, Mary E.:** Mitotic effects of prolonged irradiation with low-intensity gamma rays on the Chortophaga neuroblast (ab), April, 639
- Carothers, E. L.** See **Hahn, P. F.**
- Carotid body**
—tumors: recognition and treatment (ab), Kenneth W. Warren, April, 632
- Carpenter, Malcolm B., and Druckemiller, William H.:** Agnesis of the corpus callosum diagnosed during life. Review of the literature and presentation of two cases (ab), Jan., 124
- Carpus.** See **Scaphoid Bone, Carpal; Wrist**
- Carr, J. A.:** The pathology of urinary calculi: radial striation (ab), Jan., 147
- Carr, R. J.** See **Martin, F. R. R.**
- Carré, Ivo J.** See **Astley, Roy**
- Carrier, John W.** See **Miller, Clark F.**
- Carrar, Magdalene S.** See **Thomson, John F.**
- Casarett, George W.:** Comparison of pathologic effects of radiation in weanling and adult rats (ab), March, 476
- Cassen, Benedict.** See **Bauer, Franz K.**
- See **Yuhl, Eric T.**
- Castellano, Francesco.** See **Ruggiero, Giovanni**
- Casten, Gus G.** See **Marsh, Julian B.**
- Casts**
—casts of cerebral ventricles (ab), R. J. Last and D. H. Tompsett, May, 442
- Cataract**
roentgen cataract: effects of shielding of lens and ciliary body (ab), A. J. Alter and P. J. Leinfelder, Jan., 158
- Cathartics**
—the purged colon, F. C. Jewell and John R. Kline, March, 368
- Catheterization.** See **Heart**
- Cathode rays**
—high-energy electrons for treatment of extensive superficial malignant lesions (ab), John G. Trump et al, Feb., 310
- Catinot, L.** See **Loiseleur, J.**
- Cavernous sinus**
—carotid cavernous fistula with signs on contralateral side; case report (ab), Miguel Ramos and Lester A. Mount, Jan., 127
- CCK (Hydargine).** See **Gastrointestinal Tract, diseases**
- Cecum.** See **Intestines, tuberculosis**
- Celiac disease**
—volvulus of colon: a complication of sprue (ab), Israel Glazer and David Adlersberg, April, 621
- Cells**
—mitotic effects of prolonged irradiation with low-intensity gamma rays on Chortophaga neuroblast (ab), J. Gordon Carlson et al, April, 639
- Cerebellum**
—cerebellar medulloblastoma: treatment by irradiation of whole nervous system (ab), Edith Paterson and R. F. Farr, Feb., 307
—vertebral angiography in cerebellar hemangioma (ab), Olle Olsson, May, 765
- Cerebrum.** See **Brain**
- Chadwick, R. C.** See **Chamberlain, A. C.**
- Chaiken, Bernard H., Levy, Bertram L., and Wirts, C. Wilmer:** Coexistence of peptic ulcer and idiopathic ulcerative colitis (ab), March, 454
- Chaikoff, I. L.** See **Briggs, F. N.**
- Chalmers, T. A.** See **Cox, L. Woodrow**
- Chamberlain, A. C., and Chadwick, R. C.:** Deposition of airborne radiiodine vapor (ab), June, 916
- Chamberlain bi-plane stereoscope.** See **Roentgen Rays, apparatus**
- Chamberlain, Harold A., and Hovenanian, Michael S.:** Aneurysm of accessory renal artery (ab), Jan., 148
- Chandler, Fremont A.** See **Adams, Raymond J.**
- Chapman, Earle M.** See **Dobyns, Brown M.**
- Chardack, William M., and MacCallum, James D.:** Pancoast syndrome due to bronchiogenic carcinoma: successful surgical removal and postoperative irradiation. A case report (ab), Feb., 308
- Charr, Robert:** Histoplasmosis. Report of two cases (ab), Jan., 127
Respiratory disorders among welders (ab), May, 770
- Chassar Moir graphs.** See **Pelvis, measurement**
- Chemicals and chemistry**
—chemical synthesis following action of physical peroxidase agents (roentgen rays, ultraviolet and ultrasonic rays) (ab), A. Lacassagne and J. Loiseleur, May, 709
—chemical synthesis following action of roentgen rays (ab), A. Lacassagne and J. Loiseleur, May, 709
—detection of cosmic radiation by chemical methods (ab), J. Eugster, Jan., 162
- Chérigüé, E., Laporte, A., and Verspyck, R.:** Radiologic aspect of the small intestine in typhoid fever (ab), May, 778
- Cherry, Glenn R.** See **Bassett, Robert C.**
- Chiappa, Sergio, and Sacchi, Adolfo:** A rare manifestation of vertebral angiodoma (ab), Feb., 298
- Childe, Arthur E.:** Localized thinning and enlargement of the cranium with special reference to the middle fossa (ab), May, 766
- Parkinson, Dwight, and Hoogstraten, Jan:** Ventriclegraphic examination of the aqueduct of Sylvius and fourth ventricle. A report of five unusual cases (ab), June, 888
- Children**
See also Bones, growth; Bones, pathology; Heart, abnormalities; Infants, Newborn; Leukemia; Peptic Ulcer
—benign form of acute osteitis of spine in young children (ab), A. E. Bremner and G. A. Neligan, Feb., 297
—calcification of intervertebral disks in childhood, Frederic N. Silverman, June, 801
—clinical diagnosis of generalized cytomegalic inclusion disease (ab), Robert D. Mercer et al, March, 466
—contribution to congenital syphilis (ab), Z. Gregor and M. Kovárová, March, 460
—developmental defects following irradiation of ovaries in child (ab), U. V. Portmann and E. Perry McCullagh, Jan., 158
—double contrast studies of colon: polyps in children (ab), Charles W. Yates, Feb., 294
—gastro-esophageal incompetence in children with special reference to minor degrees of partial thoracic stomach, Roy Astley and Ivo J. Carré, March, 351
—healing aspects of skull fractures in children (ab), H. W. Pia, Feb., 282
—horizontal lateral roentgenography of hip in children; preliminary report (ab), Herbert Laage et al, Feb., 300
—idiopathic juvenile pulmonary hemosiderosis (ab), C. J. Hodson et al, May, 770
—intestinal obstruction in neonatal period (ab), George Davison and T. R. Harlan, Feb., 293
—kerosene poisoning in young children, Joseph C. Foley, Nicholas B. Dreyer, A. Bradley Soule, Jr., and Ephraim Woll, June, 817

CHILDREN—cont.

- lobar obstructive emphysema in infancy treated by lobectomy (ab), Herbert Sloan, April, 607
- lung cyst in infancy; case (ab), Doreen Murphy, March, 447
- Meigs' syndrome; case in child (ab), William E. Knaus et al., April, 625
- osteoneuropathy with vascular calcification in infancy; case, Eugene F. Pendergrass and Frank P. Brooks, Feb., 227
- physical growth and development of children who survived the atomic bombing of Hiroshima or Nagasaki (ab), William W. Greulich et al., June, 921
- primary myocardial disease in infancy and childhood (ab), Harold D. Rosenbaum et al., May, 772
- retroperitoneal tumors in children: roentgen diagnosis (ab), Howard L. Steinbach and Reynold F. Brown, Feb., 305
- roentgen manifestations of unrecognized skeletal trauma in infants (ab), Frederic N. Silverman, March, 456
- septic arthritis and osteomyelitis in infancy (ab), Seymour Heymann et al., March, 458
- spontaneous intracranial hemorrhage in children; 8 cases in children of 15 years of age or younger (ab), Wallace P. Ritchie and Gerald Haines, Feb., 282
- technic of bronchography in children (ab), Paul Ch. Schmid, Feb., 284
- tonsillar hypertrophy and mediastinal-hilar adenopathy (ab), Carlo Dazzi, Feb., 287
- translumbar aortography in infants utilizing 70 per cent Urokon as contrast medium (ab), W. F. Melick et al., Jan., 149
- true pancreatic cyst in early infancy; case (ab), Albert Calderin Gomez, Feb., 296
- use of gastric distention as aid to pediatric urography (ab), David H. Allen, April, 628
- CHLORIDES, RADIOACTIVE.** See Radioactivity
- CHOHANY, GEORGE.** See BECK, WILLIAM C.
- CHOLANGIOGRAPHY.** See Bile Ducts
- CHOLECYSTECTOMY.** See Gallbladder
- CHOLECYSTITIS.** See Gallbladder, diseases
- CHOLECYSTOGRAPHY.** See Gallbladder
- CHOLEDOCHOGRAPHY.** See Bile Ducts
- CHOLEGRAPHIN (Biligratin).** See Bile Ducts
- CHONDRODYSPLASIA CALCIFICANS CONGENITA.** See Achondroplasia
- CHONDROMA.** See Tumors, chondroma
- CHORDOMA.** See Tumors, chordoma
- CHRISTOPHERSEN, WILLIAM M.** See BERG, HAROLD F.
- CHROMOPHOBE TUMORS.** See Pituitary Body
- CHURCHILL, A. S.: Bronchogenic carcinoma in San Diego County.** Relation of mortality rates to findings in mass chest x-ray survey (ab), Jan., 130
- CHURCHILL-DAVIDSON, I.: A technique of simulated rotation therapy for the treatment of carcinoma of the bronchus (ab), April, 634**
- CHUTE, A. L.** See KEITH, JOHN D.
- CINEFLUOROGRAPHY.** See Cineradiography
- CINERADIOGRAPHY**
 - cinematographic studies of cardiovascular disease (ab), Robert F. Rushmer et al., March, 448
 - vesical physiology demonstrated by cineradiography and serial roentgenography; preliminary report, Frank Hinman, Jr., Gerald M. Miller, Eldon Nickel and Earl R. Miller, May, 713
- CIRRHOSIS.** See Liver
- CISTERNS, CEREBRAL**
 - cisternography (ab), S. Masy and A. Grégoire, June, 890
 - laminography in study of cerebral sulci and cisternal spaces (ab), Fermo Mascherpa and Guido Lombardi, Jan., 124
 - pneumoencephalography, with special reference to demonstration of basal cisterns (ab), P. W. E. Sheldon et al., Feb., 281
- CITRATES**
 - protecting action of citrate on agent of chicken Tumor I (Rous sarcoma virus) during roentgen radiation in vitro (ab), W. Ray Bryan et al., May, 798
- CLEMENTS, J. LUTHER.** See WEENS, H. STEPHEN
- CLIFFTON, EUGENE E., and BLANSFIELD, HENRY N.: The treatment of carcinoma of the esophagus by radiation therapy and surgery.** Case report (ab), March, 468
- CLINOID PROCESS.** See Sphenoid Bone
- COBALT, RADIOACTIVE.** See Radioactivity
- COCCHI, UMBERTO:** The roentgen diagnosis of peptic ulcer of the esophagus (ab), June, 900
- COCCIDIOIDOMYCOSIS**
 - coexisting pulmonary coccidioidomycosis and tuberculosis (ab), Hans F. Stein, Feb., 285
- COHN, E. M.** See ORLOFF, T. L.
- COHN, S. H., and GONG, J. K.: Effect of 2,000 roentgens local x-irradiation on metabolism and alkaline phosphatase activity of rat bone (ab), Feb., 319**
- Radon inhalation studies in rats (ab), May, 798**
- COLCHICINE, RADIOACTIVE.** See Radioactivity
- COLE, A., MOORE, E. B., and SHALEK, R. J.: A simplified automatic isodose recorder (ab), Feb., 311**
- COLEY, BRADLEY L.** See BAKER, HARVEY W.
- COLITIS**
 - coexistence of peptic ulcer and idiopathic ulcerative colitis (ab), Bernard H. Chaiken et al., March, 454
 - tannin enema in inflammatory conditions of colon (ab), E. Zilansky et al., June, 903
- COLLINS, LOIS C.** See DEDICK, ANDREW P.

COLON

- See also Colitis; Fistula; Intestines
- spontaneous perforation of benign gastric ulcer into transverse colon; case (ab), William R. Bosien and M. Dawson Tyson, March, 454
- the purged colon, F. C. Jewell and John R. Kline, March, 368
- CANCER**
 - adenomas of colon and rectum: diagnosis and treatment in relation to cancer prevention (ab), Paul C. Morton, May, 778
- ROENTGENOGRAPHY.** See also Colon, tumors; Intestines
 - double-contrast manifestations of non-polypoid diseases (ab), Clyde A. Stevenson and McClure Wilson, April, 621
- TUMORS.** See also Colon, cancer
 - double contrast studies of colon: polyps in children (ab), Charles W. Yates, Feb., 294
 - osteomatosis (leontiasis ossea): hereditary disease of membranous bone formation associated in one family with polyposis of colon, Henry P. Plenk and Eldon J. Gardner, June, 830
- VOLVULUS.** See Intestines, volvulus
- COLP, RALPH, and WEINSTEIN, VERNON A.: Benign tumors of the stomach (ab), Feb., 292**
- COLVIN, E. M., and WALKER, J. FRANK:** Ascending erect phlebography (ab), May, 788
- WALKER, J. FRANK, and SMITH, HORACE D.: Ascending erect phlebography. Management of chronic venous insufficiency of lower extremity (ab), Jan., 150
- COMAR, C. L.** See HANSARD, SAM L.
- See RUST, JOHN H.
- COMSTOCK, GEORGE W.: Mortality of persons with photofluorograms suggestive of cardiovascular disease (ab), April, 611**
- COOKE, JEAN V.: Chronic myelogenous leukemia in children (ab), March, 471**
- COOLEY, DENTON A.: The clinical significance of cavernolithiasis (ab), Jan., 130**
- COOPERMAN, NORMAN R.** See RUBOVITS, FRANK E.
- COPELAND, HERBERT.** See BERMAN, MICHAEL H.
- COPPER**
 - bone disorder associated with copper deficiency: I. Gross morphological, roentgenological, and chemical observations (ab), James H. Baxter and Judson J. Van Wyk, May, 783
- COR PULMONALE.** See Heart, dilatation
- CORONARY VESSELS**
 - contribution to topography of cardiac orifices and their interrelationship: opacification of coronary vessels (ab) Georges Apostolakis and Issidore G. Gounaris, May, 772
- CORPUS CALLOSUM**
 - agenesis diagnosed during life: review of literature and presentation of 2 cases (ab), Malcolm B. Carpenter and William H. Druckemiller, Jan., 124
 - agenesis with concomitant malformations, including atresia of foramina of Luschka and Magendie (ab), Eugene F. Van Epps, May, 765
 - lipoma; case (ab), Charles D. Smith and Edgar N. Weaver, Feb., 282
 - radiological diagnosis of lipoma (ab), Poul E. Andersen, June, 892
- CORTISONE.** See Adrenocortical Preparations
- COSBY, RICHARD S.** See JACOBSON, GEORGE
- COSMIC RAYS**
 - detection of cosmic radiation by chemical methods (ab), J. Eugster, Jan., 162
- COSTIGAN, WILLIAM J.** See STEENKEN, WILLIAM, Jr.
- COULTER, MOLLY P.** See FURTH, FRANK W.
- COUNTERS**
 - evaluation of a thyroid panel: practical application of scintillation counter in diseases of thyroid (ab), T. F. Barrett et al., June, 916
 - multiple-counter system for isotope encephalometry (ab), Douglas A. Kohl, June, 916
- COURNAND, ANDRE (Chairman): Report of Committee (of American Heart Association) on Cardiac Catheterization and Angiocardiology (ab), March, 449**
- COWART, G. T.** See BERGER, I. R.
- COWING, R. F.** See FOGG, L. C.
- COX, L. WOODROW, and CHALMERS, T. A.: Effect of pre-eclamptic toxemia on the exchange of sodium in the body and the transfer of sodium across the placenta measured by Na²⁴ tracer methods (ab), Feb., 316**
- Exchange of sodium between plasma and extracellular compartments in pregnant women as determined by Na²⁴ tracer methods (ab), Feb., 316**
- Transfer of sodium across the human placenta determined by Na²⁴ tracer methods (ab), Feb., 316**
- Transfer of sodium to the amniotic fluid in normal and abnormal cases, determined by Na²⁴ tracer methods (ab), Feb., 316**
- Transfer of sodium to the placental blood during the third stage of labour determined by Na²⁴ tracer methods (ab), Feb., 316**
- COX, ROBERT S., Jr.** See THOMSON, JOHN F.
- COXA PLANA.** See Osteochondritis deformans juvenilis
- CRAIG, WINCHELL MCK.** See RAAF, JOHN
- CRANE, JACKSON T.** See STEINBACH, HOWARD L.
- CRANE, LAWRENCE.** See RYDER, CHARLES T.
- CRANIOMETRY**
 - assessment of value of Chassard Moir graphs in radiological investigation of cephalopelvic disproportion (ab), John P. Erskine et al., April, 627

- CRANIOMETRY**—*cont.*
—intra-uterine growth of fetal head after 36th week of pregnancy (ab), Derk Crichton, Feb., 302
- CRANIUM**
—See also Craniometry
—localized thinning and enlargement of cranium, with special reference to middle fossa (ab), Arthur E. Childe, May, 766
- fractures**
—healing aspects of fractures in children (ab), H.-W. Pia, Feb., 282
- pathology**
—Troell-Juett syndrome (acromegaly complicated by thyroid toxicity and hyperostosis of skull) (ab), Sherwood Moore April, 606
- roentgenography**
—cranial tomography in neuroradiology. Tomography of base of skull (ab), R. Bourdon, June, 891
—some aspects of radiologic diagnosis of posterior fossa and suprasellar tumors (ab), Ingmar Wickbom and Philip Sheldon, June, 803
- CREeping ERUPTION**
—associated with transient pulmonary infiltrations, Edmond H. Kalmon, Feb., 222
- CRETINISM**
—radioactive-iodine studies in non-endemic goitrous cretinism (ab), E. M. McGirr and James H. Hutchison, April, 636
- CRICHTON, DERK**: The intra-uterine growth of the foetal head after the 36th week of pregnancy (ab), Feb., 302
- CRILE, GEORGE, Jr., and GROVES, L. K.**: Massive leiomyosarcoma of the stomach. Report of 5 cases (ab), May, 775
- CRIMSON, CATHERINE S.** See GREULICH, WILLIAM W.
- CROHN'S DISEASE**. See Intestines
- CROWE, GERALD E.** See PARK, FELIX R.
- CROWK, ROBERT T.** See PARK, FELIX R.
- CRYSTAL, DEAN K.** See RUSHMER, ROBERT F.
- CULLINAN, EDWARD R., HARPER, R. A. KEMP, ET AL.**: Discussion on scleroderma (ab), May, 790
- CULP, D. A.**: Testicular neoplasms: an analysis of 113 cases (ab), June, 914
- CULP, DAVID**. See KERR, H. DABNEY
- CUMMINS, CHRISTOPHER, and SILVER, C. P.**: Bronchography with a rapidly eliminated compound "Dionosil" (ab), June, 894
- CUNEIFORM BONE**. See Foot
- CUNNIE, ROBERT W.**: Technical modification of routine chest radiographs (ab), April, 610
- CURRY, JOSEPH L.** See LEHMAN, J. STAUFFER
- CURRY, ROBERT W.**: A simple method of roentgen pelvimetry (ab), Feb., 302
- CURTIS, GEORGE M.** See MECKSTROTH, CHARLES V.
- CYSTADENOCARCINOMA**. See Ovary, cancer
- CYSTICERCOISIS**. See Brain
- CYSTS** See Brain; Esophagus; Kidneys; Lungs; Meninges; Pancreas; Sacrum; etc.
- CYTOMEGALIC INCLUSION DISEASE**
—clinical diagnosis of generalized cytomegalic inclusion disease (ab), Robert D. Mercer et al, March, 466
- CYTOSIDEROISIS**
—absorption of iron. Radioiron studies in idiopathic hemochromatosis, malnutritional cytosiderosis, and transfusional hemosiderosis (ab), T. H. Bothwell et al, April, 638
- CZECH, H., and KEPP, R. K.**: Recurrences after treatment of malignant tumors of the female genitalia (ab), Jan., 153
- D**
- DARBY, WILLIAM J.** See PEARSON, W. N.
- DARNELL, CARL**, eightieth birthday, June, 879
- DAS-GUPTA, N. N.** See BHATTACHARYA, K. L.
- DATTA-CHAUDHURY, R.** See BHATTACHARYA, K. L.
- DAVID, M.** See FISCHGOLD, H.
- DAVIDON, W. C.** See OBRZYCKI, R. F.
- DAVIDS, ARTHUR M.**: X-ray diagnosis of uterine pathology (ab), April, 625
- DAVIDSON, CHARLES N., DENNIS, JOHN M., McNINCH, EUGENE R., WILLSON, JAMES K. V., and BROWN, WEBSTER H.**: Nephrocalcinosis associated with sarcoidosis. A presentation and discussion of seven cases, Feb., 203
- DAVIES, JOHN J., and PEIRCE, E. CONVERSE, II**: Discography in the diagnosis of herniation of the lower lumbar intervertebral discs (ab), June, 907
- DAVIS, CARL, Jr., DORSEY, JOHN, and SCANLON, EDWARD**: Cysts about the pericardium (ab), April, 612
- DAVISON, GEORGE, and HARLAN, T. R.**: Intestinal obstruction in the neonatal period (ab), Feb., 293
- DAVISON, SOL, GOLDBLITH, SAMUEL A., PROCTOR, BERNARD E., KAREL, MARCUS, KAN, BILLY, and BATES, CHARLES J.**: Dosimetry of a kilocurie cobalt-60 source (ab), June, 918
- DAZZI, CARLO**: Tonsillar hypertrophy and mediastinal-hilar adenopathy (ab), Feb., 287
- DEARING, RUTH**: A study of the renal tract in carcinoma of the cervix (ab), Feb., 305
- DECKER, K.**: Displacement of the posterior cerebral artery in vertebral angiograms (ab), June, 889
- DeCOURSEY, ELBERT**: Effects of midlethal doses of total body ionizing radiations (ab), Jan., 159
- DEDICK, ANDREW P., and COLLINS, LOIS C.**: The roentgen diagnosis of bleeding lesions of the small intestine (ab), April, 620
- De FEO, EDWARD**: Osteomyelitis of the spine following prosthetic surgery, March, 396
- De HAENE, R.**: Concerning eighty disk opacifications. Interest and indications of diacography (ab), March, 462
- DISKOGRAPHY** (ab), Jan., 144
- DELARUE, J., DEPIERRE, R., PAILLAS, J., and POINTILLART, J.**: The association of tuberculosis and primary bronchogenic cancers (ab), March, 446
- DELARUE, NORMAN C.** See ASH, C. L.
- deLORIMIER, A. A.**: Arthropathies of the temporo-mandibular joint. Roentgenologic aspects (ab), March, 459
- See PARKER, LEON O.
- DELORME, THOMAS L.** See BARR, JOSEPH S.
- de MARCHI, RENATO**. See MENEGHINI, CARLO
- DEMY, N. G., and GEWANTER, A. P.**: Correlation of upper lobe vascularization with certain congenital intracardiac shunts, March, 329
- DENNIS, JOHN M.** See DAVIDSON, CHARLES N.
- DEPIERRE, R.** See DELARUE, J.
- DERINGER, MARGARET K.** See HESTON, W. E.
- DETAR, JOHN H.** See BOYCE, WILLIAM H.
- DEUTSCHBERGER, OTTO, MAGLIONE, ANTHONY A., and GILL, JOHN J.**: An unusual case of intrathoracic fibroma associated with pulmonary hypertrophic osteoarthropathy (ab), March, 446
- DIABETES MELLITUS**
—intrauterine roentgenography as an aid in determining fetal age (in diabetic mothers); preliminary report (ab), Theodore W. Adams et al, June, 907
- DIAPHRAGM**
—See also Hernia, diaphragmatic
—intestinal obstruction with congenital absence of left diaphragm (ab), Robert T. Campbell, May, 777
—partial eventration of right diaphragm (ab), Morton M. Axler and Robert L. Rehmann, March, 450
—roentgenologic symptomatology of diaphragmatic tumors (ab), Slavoj Věšin, March, 450
- DIAPHRAGM (mucosal)**
—pyloric obstruction due to mucosal diaphragm (ab), Alexander N. Rota, Jan., 137
- DICHROMOGRAPHY**. See Roentgen Rays, technic
- DIGESTIVE SYSTEM**
—See also Gastrointestinal Tract; Intestines; Stomach; etc.
—duplications of alimentary tract in adults, with report of 3 cases (ab), John J. Nolan and J. Gordon Lee, Jan., 134
- DILLON, ROBERT F.** See GASUL, BENJAMIN M.
- DINNING, T. A. R.**: Osteoclastoma of the petrous temporal bone. Report of a case benefited by deep x-ray therapy (ab), March, 468
- DIODONE**. See Iodine and Iodine Compounds
- DIODRAST**. See Bile Ducts
- DIONOSIL**. See Bronchi, roentgenography
- DIPHENHYDRAMINE**
—effect of diphenhydramine (Benadryl) on side-reactions in intravenous urography (ab), Solomon R. Bersack and Thomas E. Whitaker, Jr., March, 463
—influence of diphenhydramine (Benadryl) on side-effects of Diodone in urography (ab), Einar Gilg, Feb., 303
- di RIENZO, S.**: Roentgen therapy of the small intestine (ab), April, 634
- Roentgenology of the operated lung** (ab), Feb., 284
- di SANT'AGNESE, PAUL A.**: Bronchial obstruction with lobar atelectasis and emphysema in cystic fibrosis of the pancreas (ab), May, 771
- DISKOGRAPHY**. See Spine, intervertebral disks
- DIVERTICULA**. See Intestines, diverticula; Urethra
- DNA (deoxyribonucleic acid)**. See Nucleins
- DOBYNS, BROWN M., VICKERY, AUSTIN L., MALOOF, FARAHE, and CHAPMAN, EARLE M.**: Functional and histologic effects of therapeutic doses of radioactive iodine on the thyroid of man (ab), March, 473
- DORR, THOMAS W.**: Roentgen diagnosis of gallstone ileus, March, 363
- DORSEY, JOHN**. See DAVIS, CARL, Jr.
- DOSIMETER**. See Radiations
- DOSS, A. KELLER**: Recent improvements in translumbar aortography (ab), Jan., 149
- DOTTER, CHARLES T.** See LUKAS, DANIEL S.
- See STEINBERG, ISRAEL
- DOUBILET, HENRY, SAGE, HAROLD H., and MULLHOLLAND, JOHN H.**: Diagnosis of biliary-pancreatic cancer (ab), Feb., 295
- DOUGHERTY, CARY M., MICKEY, LORIN J., and MOORE, JOHN T.**: Hyperextension of the fetal head in breech presentation (ab), April, 627
- DOUGLAS, MARY**: Uniformity of dosage in bladder carcinoma (ab), April, 635
- DRESCHER, H.** See REICHENMILLER, H.
- DREXLER, L.** See ZDANSKY, E.
- DREYER, NICHOLAS B.** See FOLEY, JOSEPH C.
- DRUCKER, WILLIAM H.** See CARPENTER, MALCOLM B.
- DRUMMOND, JOHN A.** See BAXTER, HAMILTON
- DUBILIER, WILLIAM, Jr.** See HONIG, EDWARD I.
- du BOULAY, GEORGE**. See SIMON, G.
- DUCTUS ARTERIOSUS**
—agenesis of lung and patent ductus arteriosus with reversal of flow; case (ab), Daniel S. Lukas et al, May, 767

- DULLIGAN, PETER J., Jr.** See LAAGE, HERBERT
DUNHAM, H. H. See ALLEN, MAX S.
DUNLAP, KNOX, SHANDS, A. R., Jr., HOLLISTER, LUCIUS C., Jr., GAUL, J. STUART, Jr., and STREIT, HAROLD A.: A new method for determination of torsion of the femur (ab), Feb., 300
DUODENUM
 See also Stomach, mucosa
 —cholecystectomy and its relation to stomach and duodenum; review of 75 cases with preoperative and postoperative x-ray studies (ab), Robert E. Rothenberg, Feb., 294
 —clinical significance of pharmacoradiography, particularly of morphine, in diseases of stomach and duodenum (ab), H. U. Stössel, June, 901
 —duodenal atresia (ab), William C. Beck and George Chohan, March, 455
 —experimental gastrojejunal ulcers produced by reversing duodenum (ab), John M. Hammer et al, April, 619
CANCER
 —primary carcinoma of third portion (ab), David H. Poer, April, 620
Stula. See Fistula
tumors
 —leiomyosarcoma; case; summary of literature (ab), Mandel Weinstein and Morton Roberts, Jan., 138
 —ulcers. See Peptic Ulcer
DUOMARCO, JOSÉ. See RIMINI, RICARDO
Du PREEZ, M. L. See BOTHWELL, T. H.
DURA MATER
 —pneumographic diagnosis of meningioma of falx (ab), Ture Andersson, June, 888
DuSAULT, LUCILLE. See NOLAN, JAMES F.
DWARFISM
 renal
 —osteoneuropathy with vascular calcification in infancy; case, Eugene P. Pendergrass and Frank P. Brooks, Feb., 227
 —pathogenesis and therapy of renal osteopathy (renal rickets) (ab), S. Bettge and C. Feigl, April, 628
DYSART, D. N. See SEEDORF, E. E.
DYSPHAGIA
 —produced by contractile ring in lower esophagus (ab), Franz J. Ingelfinger and Philip Kramer, Jan., 135
DYSPLASIA, ECTODERMAL. See Ectodermal Defect
DYSPLASIA, FIBROUS. See Bones, diseases
- E**
- EBERHARD, THEODORE P.:** Radium in the treatment of cancer of the tongue (ab), March, 469
EBERT, R. H. See BARCLAY, W. R.
ECHINOCOCCOSIS
 See also Kidneys, echinococcosis
 —hydatid disease (ab), Y. Jidejian, April, 630
 —hydatid disease (ab), W. J. Latham, May, 789
ECK, H.: The marginal shadow sign of the heart (ab), Jan., 133
ECKEY, PAUL: Intestinal tuberculosis: roentgenologic and clinical observations of an atypical case (ab), May, 778
ECLAMPSIA. See Pregnancy
ECTODERMAL DEFECT
 —fourteen-year report of facial growth in case of complete anodontia with ectodermal dysplasia (ab), Bernard G. Sarnat et al, May, 767
EDITORIALS
 Pendergrass, Eugene P., president of the Radiological Society of North America, Robert P. Barden, Feb. 263
 radiologist's role in intussusception, April, 594
 Units, Lauriston S. Taylor, Secretary, Jan., 106
 reflections on hiatus hernia and related problems, Alan S. Johnstone, May, 750
 so you are going to present a scientific paper, Robert P. Barden, June, 875
 trends in modern medicine (presidential address), Ira H. Lockwood, March, 427
EDLING, NILS P. G.: Radiologic appearances of diverticula of the male cavernous urethra (ab), May, 787
 Radiologic appearances of heart, esophagus and lungs in funnel chest deformity (ab), Feb., 288
EEK, SIGURD. See ENGESET, ARNE
EFFUSION. See Abdomen; Pericarditis; Pleura, effusions
EGGMANN, P.: Malignant tumors of the nasal fossa and ethmoid. A radiologic study. An attempt at topographic classification (ab), Jan., 126
EGMARK, A., LARSSON, L.-G., LILJESTRAND, Å., and RAGNHEIM, LINGER: Iodine-concentrating thyroid carcinomas. A report of three cases (ab), March, 474
EICHEL, HERBERT J., and ROTH, JAY S.: Effect of x-irradiation on nuclease activity and respiration of Tetrahymena geleii (W. ab), April, 639
EISENBUD, M. See HARRIS, W. B.
ELDER, BERGLIOT. See ELDER, EARL
ELDER, EARL, and ELDER, BERGLIOT: Effects of total body x-irradiation on the peripheral blood of the monkey (ab), Jan., 161
 —and TROWBRIDGE, WILLIAM V.: Radiation sickness in the monkey, Jan., 65
ELECTROCARDIOGRAPHY. See Heart
ELECTROENCEPHALOGRAPHY. See Brain
ELECTROKYMOGRAPHY. See Heart

ELECTRONS

- See also Betatron
 —effect of chamber voltage on electron build-up measurements, Jasper, E. Richardson, April, 584
 —high energy electrons for treatment of extensive superficial malignant lesions (ab), John G. Trump et al, Feb., 310
ELKAN, WOLF. See NISSEN, R.
ELKELES, A.: Parathyroid tumour with hyperparathyroidism and coexistent gastric and duodenal ulceration (ab), Feb., 287
ELKIN, MILTON, ETTINGER, ALICE, and PHILLIPS ROBERT I.: Simple determination of tomographic levels, Feb., 198
 —See ETTINGER, ALICE
ELKINS, H. B. See KERR, H. DABNEY
ELLIOTT, HELEN F. See MARSH, JULIAN B.
ELLIS, V. H.: The diagnosis of shoulder lesions due to injuries of the rotator cuff (ab), Jan., 144
ELLISON, ROBERT G. See RANDELL, HERBERT T., Jr.
ELLISTON, WILLIAM A. See BARR, JOSEPH S.
EMBOLISM
 —translumbar aortography as diagnostic aid in localizing arterial emboli (ab), Charles G. Lovingood and Richard Patton, May, 787
EMBRYO
 —studies on blood-brain barrier with radioactive phosphorus. III. Embryonic development of barrier (ab), Louis Bakay, May, 795
EMPHYSEMA
 mediastinal
 —following tonsillectomy (ab), Jacob J. Silverman et al, Feb., 287
 pulmonary
 —bronchial obstruction with lobar atelectasis and emphysema in cystic fibrosis of pancreas (ab), Paul A. di Sant'Agnes, May, 771
 —lobar obstructive emphysema in infancy treated by lobectomy (ab), Herbert Sloan, April, 607
ENCEPHALOGRAPHY. See Brain
ENCEPHALOMETRY. See Brain, tumors
ENCHONDROMA. See Tumors, chondroma
ENDOCARDIUM. See Heart, abnormalities
ENEMAS. See Intussusception; Tannin
ENGESSET, ARNE, EEK, SIGURD, and GILJE, OSCAR: On the significance of growth in the roentgenological skeletal changes in early congenital syphilis (ab), Feb., 296
ENGELDT, B. See HEDENBERG, I.
ENGSTRÖM, A. See HEDENBERG, I.
ENTERITIS. See Intestines, diseases
ENZYMES
 See also Streptodornase and Streptokinase
 —effect of x-irradiation on nuclease activity and respiration of Tetrahymena geleii (W. ab), Herbert J. Eichel and Jay S. Roth, April, 639
EOSINOPHILS
 —eosinophilic granuloma of bone with roentgenographic demonstration of a sequestrum; case (ab), Richard G. Wilson et al, April, 623
 —histiocytosis X. Integration of eosinophilic granuloma of bone, "Letterer-Siwe disease," and "Schüller-Christian disease" as related manifestations of single nosologic entity (ab), Louis Lichtenstein, May, 782
EPIDERMIS
 —rare radiologic finding: an endophalangeal cyst from an epidermal implant (ab), Gianfranco Mazzoleni, April, 624
EPILEPSY
 —cerebral calcification epilepsy; case of epilepsy caused by calcified hamartoma of brain (ab), W. Stewart Alexander, Jan., 125
EPIPHYSES
 —epiphyseal injuries of radial head and neck (ab), Sawnie R. Gaston et al, Jan., 144
 —peculiar structural changes in epiphyseal and metaphyseal regions in osteogenesis imperfecta tarda (ab), G. Liess, June, 906
EPPRECHT, W., ROSENEMUND, H., and SCHINZ, H. R.: Chemical, mineralogic, and x-ray diffraction investigation of gallstones of man and cattle (ab), May, 780
ERGOT PREPARATIONS
 —control of radiation sickness with dihydroergotamine (ab), K. Werner, March, 475
ERRINGTON, R. F. See GREEN, D. T.
ERSKINE, JOHN P., KELHAM, GEOFFREY, and WIUM, PETER P.: An assessment of the value of the Chassair Moir graphs in the radiological investigation of cephalopelvic disproportion (ab), April, 627
ERYTHROCYTES
 —blood volume in pregnancy as determined by P³² labeled red blood cells (ab), Nathaniel I. Berlin et al, June, 917
 —comparison of potassium⁴², rubidium⁸⁶, and cesium¹³⁴ as tracers of potassium in study of cation metabolism of human erythrocytes in vitro (ab), William D. Love and George E. Burch, Jan., 157
 —concomitant in vivo measurement of regional erythrocyte and plasma concentrations using I¹³¹ and P³² (ab), Allen F. Reid and Ben Wilson, March, 474
 —erythrocyte life span in small animals: comparison of two methods using radioiron (ab), E. Langdon Burwell et al, Jan., 158
 —in vitro studies of aspects of metabolism of sodium by human erythrocytes using sodium (ab), William D. Love and George E. Burch, Jan., 158

- ESKRIDGE, MARSHALL and PEAKE, JOHN D.:** Curling of the esophagus (ab), Jan., 135
- ESOPHAGUS**
- curling (ab), Marshall Eskridge and John D. Peake, Jan., 135
 - dysphagia produced by contractile ring in lower esophagus (ab), Franz J. Ingelfinger and Philip Kramer, Jan., 135
 - gastro-esophageal incompetence in children, with special reference to minor degrees of partial thoracic stomach, Roy Astley and Ivo J. Carré, March, 351
 - gastro-esophageal regurgitation: its incidence and relation to symptoms (ab), L. Werbeloff and C. Merskey, June, 900
 - cancer**
 - difficulties in early diagnosis of carcinoma (ab), R. Nissen, June, 900
 - results of supravoltage roentgenotherapy of carcinoma (ab), Franz Buschke and S. T. Cantril, April, 633
 - treatment of carcinoma by radiation therapy and surgery: case (ab), Eugene E. Clifton and Henry N. Blansfield, March, 468
 - cysts**
 - benign tumors and cysts (ab), R. S. Totten et al, April, 616
 - foreign bodies.** See Esophagus, perforation
 - obstruction**
 - due to Scutran (ab), A. Melamed and A. Marck, March, 451
 - perforation**
 - foreign bodies and roentgen examination of perforation (ab), Elco Huizinga, Jan., 135
 - roentgenography.** See also other subheads under Esophagus
 - radiologic appearances of heart, esophagus, and lungs in funnel chest deformity (ab), Nils P. G. Edling, Feb., 288
 - rupture**
 - partial spontaneous rupture (ab), E. M. Nanson and R. Milnes Walker, March, 451
 - tumors**
 - benign tumors and cysts (ab), R. S. Totten et al, April, 616
 - ulcers**
 - roentgen diagnosis of peptic ulcer (ab), Umberto Cocchi, June, 900
 - with severe kyphoscoliosis (ab), R. Haubrich, Feb., 291
 - varix**
 - proof of varices and their clinical significance in portal hypertension (ab), François Robert and Theo Hoffmann, May, 774
- ETHMOID SINUS**
- malignant tumors of nasal fossa and ethmoid: radiologic study. Attempt at topographic classification (ab), P. Eggimann, Jan., 126
- ETTINGER, ALICE, and ELKIN, MILTON:** Value of plain film in renal mass lesions (tumors and cysts), March, 372
- See **ELKIN, MILTON**
- EUGSTER, J.:** Detection of cosmic radiation by chemical methods (ab), Jan., 162
- EVANS, JOHN:** Leontiasis ossea. A critical review, with reports of four original cases (ab), March, 456
- EVANS, JOHN C., and ACKERMAN, LAUREN V.:** Irradiated and obstructed submaxillary salivary glands simulating cervical lymph node metastasis, April, 550
- EVANS, W. W.** See **TRUMP, JOHN G.**
- EWING'S SARCOMA.** See Tumors, Ewing's
- EXOPHTHALMOS.** See Goiter, Exophthalmic
- EXTREMITIES**
- See also Arms
 - effect of Priscoline on clearance of radiosodium from muscle and skin of man in normal and diseased limbs (ab), Jack Freund et al, May, 796
 - importance of abdominal aortography in study of ischemic syndromes of lower limbs (ab), L. Possati, April, 629
 - blood supply**
 - arteriography: a simple technic (ab), Ian MacKenzie and H. A. R. Hamilton, Jan., 150
 - ascending erect phlebography (ab), E. M. Colvin and J. Frank Walker, May, 788
 - ascending erect phlebography: management of chronic venous insufficiency of lower extremity (ab), E. M. Colvin et al, Jan., 150
 - new technic of venography of lower extremities with Urokon (ab), William H. Boyce et al, Feb., 306
 - selective arteriography (ab), Detlev Schoen, March, 465
 - studies in peripheral arterial occlusive disease. I. Methods and pathologic findings in amputated limbs (ab), Stanford Wessler and Monroe J. Schlesinger, March, 465
 - sympathectomy in chronic occlusive arterial disease (ab), W. Graham Knox and Herbert Parsons, March, 466
 - vasographic contribution to etiology and genesis of crural ulcer (ab), E. Vogler, May, 788
- EYES**
- See also Cataract; Glasses; Orbit; Sclera; Uveitis
 - meningiomas of anterior clinoid process as cause of unilateral loss of vision: surgical considerations (ab), Alfred Uihlein and Robert D. Weyand, Jan., 124
- EYMER, HEINRICH, and RIES, JULIUS:** Results of radiation therapy of carcinoma of the cervix at the I. Gynecological Clinic of the University of Munich in 1945 and 1946 (ab), March, 470
- F**
- FACE**
- fourteen-year report of facial growth in case of complete anodontia with ectodermal dysplasia (ab), Bernard G. Sarnat et al, May, 767
- FALK, BENGT:** Encephalography in cases of intracranial tumours (ab), June, 888
- FALLET, G. H.** See **MARTIN, E.**
- FALLOPIAN TUBES**
- new instrument for hysterosalpingography (ab), Lennart Kjellman, May, 785
- FALLOT'S TETRALOGY.** See Heart, abnormalities
- FALK, See Meninges, tumors**
- FAMILIAL CONDITIONS**
- osteochondritis deformans coxae juvenilis: familial demonstration (ab), W. R. Hamsa and L. S. Campbell, May, 782
- FARMER, F. T.** See **POCHIN, E. E.**
- FARMERS.** See Industry and Occupations
- FARR, R. F.** See **PATERSON, EDITH FAT**
- experimental acute radiodermatitis following beta irradiation. III. Changes in water, fat, and protein content (in skin) (ab), C. C. Lushbaugh and D. B. Hale, June, 919
 - radioactive iodine-labeled fat (ab), M. C. Hoffman, Feb., 314
 - roentgen demonstration of cirrhosis of liver with fatty metamorphosis: case due to congenital fibrocystic disease, Howard L. Steinbach, Jackson T. Crane and Henry B. Bruyn, June, 858
 - x-ray determination of decomposition of fat and its fate in gastrointestinal tract (ab), H. Lidl, May, 773
- FEDORUK, S. O., JOHNS, H. E., and WATSON, T. A.:** An improved clinical dosimeter for the measurement of radiation, Feb., 177
- FEIGEL, G.** See **BETTGE, S.**
- FEINBLATT, THEODORE M., and FERGUSON, EDGAR, A.:** CCK treatment for the syndrome of vague abdominal distress, symptomatic and roentgenographic (ab), June, 903
- FELL, EGBERT H.** See **GASUL, BENJAMIN M.**
- FELSTED, E. T.** See **LOW-BEER, B. V. A.**
- FELTON, WARREN L., II.:** The reaction of pulmonary tissue to Lipiodol (ab), March, 444
- FEMUR**
- measuring femoral anteversion: the problem and a method (ab), Charles T. Ryder and Lawrence Crane, Feb., 300
 - new method for determination of torsion (ab), Knox Dunlap et al, Feb., 300
 - fractures**
 - of femoral neck after x-ray therapy for carcinoma of female genital tract (ab), Heinz Kirchhoff and Gert Imhold, March, 475
 - rare dislocations and fracture-dislocations (ab), H. Fietz, March, 459
- FERGUSON, EDGAR A.** See **FEINBLATT, THEODORE M.**
- FETT, HERBERT C., Jr.** See **LAAGE, HERBERT**
- FETUS**
- See also Craniometry
 - hyperextension of fetal head in breech presentation (ab), Cary M. Dougherty et al, April, 627
 - intrauterine roentgenography as aid in determining fetal age (ab), Theodore W. Adams et al, June, 907
 - value of lateral pelvic roentgenogram as index of fetal maturity and type of maternal pelvis (ab), J. Bay Jacobs, Feb., 302
- FIBROELASTOSIS, ENDOCARDIAL.** See Heart, abnormalities
- FIBROMA.** See Tumors, fibroma
- FIBROMYXOMA.** See Tumors, fibromyxoma
- FIBROPLASIA**
- experimental acute radiodermatitis following beta irradiation. II. The inhibition of fibroplasia (ab), C. C. Lushbaugh and J. B. Storer, June, 919
- FIEBELKORN, HANS-JOACHIM:** Radiotherapy of benign uterine bleeding (ab), Jan., 154
- FIETZ, H.:** Could a damaged liver be the cause of a lethal Panto-cain intoxication? (ab), Jan., 132
- Rare dislocations and fracture-dislocations (ab), March, 459
- FIGGE, FRANK H. J.** See **BRUNST, V. V.**
- FIGLEY, M. M.:** Accessory roentgen signs of coarctation of the aorta, May, 671
- FILMS.** See Photography
- FINCH, CLEMENT A.** See **BURWELL, E. LANGDON**
- FINCKH, E. S.** See **SCOTT, R. KAYE**
- FINERTY, JOHN C.** See **SCHNEIDER, MARTIN**
- FINGERS AND TOES**
- See also Osteoarthritis
 - melanin spots of lips, oral mucosa and digits associated with intestinal polyposis: case (ab), Lloyd F. Sherman and Robert J. Tenner, Jan., 139
 - rare radiologic finding: an endophalangeal cyst from an epidermal implant (ab), Gianfranco Mazoleni, April, 624
- FISCHER, B.** See **HESS, P.**
- FISCHER, F. K.** See **ZOLLINGER, H. U.**
- FISCHGOLD, H., DAVID, M., TALAIRACH, J., and BREGEAT, P.:** Direct opacifying injections into the venous system of the head (ab), June, 890
- FISHER, DON L.** See **GASUL, BENJAMIN M.**
- FISHER, H. RUSSELL.** See **MILLER, ALDEN H.**
- FISTULA**
- arteriovenous**
 - arteriovenous aneurysms of lung (ab), Jan Muri, May, 771
 - arteriovenous pulmonary fistula associated with hereditary hemorrhagic telangiectasis: report of their occurrence in father and son (ab), John R. Tobin, Jr., and Thomas C. Wilder, Feb., 286
 - carotid cavernous.** See Cavernous Sinus

- FISTULA—cont.**
 —nephrooduodenal
 —spontaneous nephrooduodenal fistula; review of literature and report of case (ab), George H. Jones et al, April, 629
 —renocolic
 —case (ab), John D. Briggs, and Roderick M. Neale, Feb., 305
FIELDBOURG, NIELS. See THOMAS, JOHANNES
FLATFOOT. See Foot
FLEISCHNER, FELIX G., and BERENBERG, ARNOLD L.:
 —Idiopathic pulmonary hemosiderosis, April, 522
FLETCHER, GILBERT H.: Treatment of oral cavity cancers. Present status of radiotherapy (ab), Feb., 311
 —See GRIMMETT, LEONARD G.
FLOCKS, R. H. See KERR, H. DABNEY
FLOYD, VANN T. See WEST, JOHN P.
FLUIDS
 —chloride "space" and total exchanging chloride in man measured with long-life radiochloride, Cl^{36} (ab), S. A. Threefoot et al, May, 795
FLUORESCENCE, RADIOACTIVE. See Brain, tumors
FLUORODENSOGRAPHY. See Heart, electrokymography
FLUOROSCOPY. See Roentgen Rays, fluoroscopy
FLYNN, RICHARD: Upside-down stomach in a parahialatal hernia (ab), April, 619
FLYNN, WILLIAM F. See JONES, GEORGE H.
FOGG, L. C., and COWING, R. F.: Effects of fractionated doses of x-radiation on normal and tumor tissue (ab), Feb., 318
FOLEY, JOSEPH C., DRYER, NICHOLAS B., SOULE, A. BRADLEY, JR., and WOLL, EPHRAIM: Kerosene poisoning in young children, June, 817
FOLIC ACID
 —radiological evidence of growth in children with acute leukemia treated with folic acid antagonists, Harry A. Waisman and Roger A. Harvey, Jan., 61
FOLTZ, ELTON L., HOLYOKE, JOHN B., and HEYL, HENRY L.: Brain necrosis following x-ray therapy (ab), May, 796
FOOT
 —See also Calcaneum; Tarsus
 —naviculo-cuneiform fusion in treatment of flat foot (ab), Ewen A. Jack, Jan., 145
 —on paracuneiform: some observations on an example removed at operation (ab), A. B. Morrison, March, 462
 —survey of carpal and tarsal anomalies (ab), Ronan O'Rahilly, May, 784
FORAMEN
 —Luschka's. See Brain, abnormalities
 —Magendie's. See Brain, abnormalities
MAGNUM
 —bony abnormalities in region of foramen magnum: correlation of anatomic and neurologic findings (ab), D. L. McCrae, June, 892
FOREIGN BODIES
 —foreign bodies and roentgen examination of perforation of esophagus (ab), Elco Huizinga, Jan., 135
FORSER, JAMES H. See SALYER, JOHN M.
FÓTI, M.: Roentgen examination of the stomach with tetraethylammoniumbromide (TEAB). A new pharmacodynamic procedure (ab), March, 452
FOUNDRIES. See Pneumoconiosis
FOX, BENUM W., LITTMAN, ARMAND, GROSSMAN, M. I., and IVY, A. C.: Effect of intragastric irradiation on gastric acidity in the dog (ab), May, 797
FRACHTMAN, KURT G.: Unruptured tubal term pregnancy (ab), May, 786
FRACTURES
 —See also under names of bones
 —deposition of radiophosphorus in fractured bones in rats (ab), G. W. Wilkinson and C. P. Leblond, June, 917
 —impact of Röntgen's discovery upon treatment (ab), Leonard F. Peltier, Feb., 296
FRANCE, N. E. See HODSON, C. J.
FRANK, JOE L., JR. See RAWSON, ARNOLD J.
FRANK, P. See KÖRBLER, J.
FRANKLIN, E. L. See LAURENCE, W.
FRASSINETI, A. See CACCIARI, A.
FREDZELL, GEORG. See SJÖGREN, S. E.
FREEDBERG, E. STONE. See KURLAND, GEORGE S.
FREEDMAN LECTURES. March, 430
FREETH, AUDREY: Routine x-ray examination of the chest at an antenatal clinic (ab), Jan., 131
FREUND, JACK, WISHAM, LAWRENCE H., and YALOW ROSALYN, S.: Effect of Priscoline on the clearance of radiosodium from muscle and skin of man in normal and diseased limbs (ab), May, 796
FREUNDLICH, H. F., and HAYBITTLE, J. L.: An improved iridium-192 teletherapy unit (ab), Jan., 156
FRIED, CARL: Roentgen irradiation of uveitis. Clinical and experimental results (ab), March, 471
FRIEDEL, H. L. See STORAASLI, J. P.
FRIEDMAN, A. I. See MARSHAK, RICHARD H.
FRIEDMAN, PAUL S., SOLIS-COHEN, LEON, and JOFFE, SAMUEL M.: Urethral calculus: its roentgen evaluation, Feb., 248
FRIEDMAN, ROBERT L.: Loculated azygos fissure effusion in cardiac failure (ab), Jan., 133
 —See RICHMAN, SAMUEL
FROMER, J. L. See TRUMP, JOHN G.
FROMMOLD, W.: A new contrast medium for cholecystography (ab), June, 903
FRUHMANN, G. See LIESE, E.
FUNGI. See Mycosis
FUNNEL CHEST. See Thorax
FURACIN
 —Furacin vaginal suppositories: their use with radiation therapy for malignant pelvic neoplasms (ab), Jerome Schwartz and Vincent Nardiello, March, 471
FURTH, FRANK W., COULTER, MOLLY P., MILLER, ROBERT W., HOWLAND, JOE W., and SWISHER, SCOTT, N.: Treatment of the acute radiation syndrome in dogs with Aureomycin and whole blood (ab), April, 639
FURTH, J. See WOODS, M. C.
FUSI, GIORGIO: An experimental study of the first radiologic manifestations of osteoporosis (ab), Jan., 140
 G
GABRIEL, LOUIS T., CAMPBELL, DARRELL A., and MUSSELMAN, MERLE M.: Volvulus of the sigmoid colon (ab), May, 778
GAEDE, K. See MÖCKEL, G.
GAINES, WALTER: Pneumoperitoneum in perforated peptic ulcer. Factors in roentgenographic demonstration (ab), April, 619
GALLAGHER, THOMAS F. See LAAGE, HERBERT
GALLBLADDER
 —calculi
 —chemical, mineralogic, and x-ray diffraction investigation of gallstones of man and cattle (ab), W. Epprecht et al, May, 780
 —intestinal obstruction resulting from biliary calculi (gallstone ileus) (ab), Samuel Shore et al, Jan., 138
 —roentgen diagnosis of gallstone ileus, Thomas W. Dorr, March, 363
 —cancer
 —papilloma of gallbladder with in situ carcinoma (ab), Edward J. Tabah and Gordon McNeer, May, 779
DISEASES
 —acute pneumocholecystitis; review and report of 2 cases (ab), Luther G. Bell et al, May, 779
 —chronic cholecystitis and Rokitsansky-Aschoff sinuses (ab), Henri Lapointe, April, 622
 —gallbladder disease and the roentgenologist, (ab), Charles L. Hinkel, April, 621
ROENTGENOGRAPHY
 —cholecystography: critical review, Robert Shapiro, Feb., 245
 —new contrast medium for cholecystography (Biligradin) (ab), W. Frommhold, June, 903
 —Telepaque and pseudoalbuminuria (ab), E. E. Seedorf et al, June, 905
 —use of Telepaque in cholecystography: comparative study (ab), Clark F. Miller and John W. Carrier, Feb., 295
 —visualization of common duct during cholecystography: its significance (ab), Maurice D. Sachs, March, 455
SURGERY
 —cholecystectomy and its relation to stomach and duodenum: review of 75 cases with preoperative and postoperative x-ray studies (ab), Robert E. Rothenberg, Feb., 294
TUMORS
 —papilloma of gallbladder with in situ carcinoma (ab), Edward J. Tabah and Gordon McNeer, May, 779
GALLSTONES. See Gallbladder, calculi
GALLY, L. See LEGER, L.
GALY, PIERRE. See SANTY, PAUL
GAMBLE, FRANCES N. See WOODS, M. C.
GAMMA RAYS. See Atomic Bomb; Radiations; Radioactivity; Radium
GANGLION
 —symptoms and signs referable to basal ganglia in brain tumor (ab), Daniel Sciarra and Bertram E. Sproffkin, Feb., 281
GARCIA, P. J., and LAXAMANA, A. M.: A report on the radiographic measurements of the normal sella turcica in Filipinos (ab), June, 893
GARDNER, ELTON J. See PLENK, HENRY P.
GARDNER, FRANCES, and ORAM, SAMUEL: Persistent left superior vena cava draining the pulmonary veins (ab), April, 615
GARSCHKE, R.: Intracranial calcification as a late result of tuberculous meningitis following treatment by streptomycin (ab), Feb., 282
GASTON, SAWNIE R., SMITH, FREDERICK M., and BAAB, ORREN D.: Epiphyseal injuries of the radial head and neck (ab), Jan., 144
GASTRECTOMY. See Peptic Ulcer, surgical therapy; Stomach, surgery
GASTRITIS. See Stomach, inflammation
GASTROENTEROSTOMY
 —carcinoma of stomach following gastroenterostomy for duodenal ulcer (ab), Lloyd A. Stirrett and John M. Beal, April, 618
GASTROINTESTINAL TRACT
 —See also Colon; Intestines; Stomach; etc.
 —non-malignant roentgen changes associated with aging (ab), Everett L. Pirkey et al, March, 451
 —cancer
 —x-ray diagnosis of neoplasms (ab), Robert J. Bloor, April, 616
DISEASES
 —CCK treatment for syndrome of vague abdominal distress, symptomatic and roentgenographic study (ab), Theodore M. Feinblatt and Edgar A. Ferguson, Jr., June, 903

GASTROINTESTINAL TRACT—cont.

- hemorrhage
 - bleeding from upper gastrointestinal tract. II. Role of roentgenologist (ab), Gwilym S. Lodwick, April, 616
 - management of upper gastrointestinal hemorrhage (ab), Thomas A. Warthin et al, June, 899
- roentgenography
 - x-ray determination of decomposition of fat and its fate in gastrointestinal tract (ab), H. Lidl, May, 773

GASTROSCOPY. See Stomach

- GASUL, BENJAMIN M., WEISS, HOWARD, FELL, EGBERT H., DILLON, ROBERT F., FISHER, DON L., and MAR-ENFELD, CARL J.:** Angiocardiography in congenital heart disease correlated with clinical and autopsy findings. A five-year clinical and pathological study of thirty-four cases in infants and young children out of a series of eleven hundred patients, and four hundred twenty-five angiocardiograms (ab), Feb., 288

GAUL, J. STUART, Jr. See **DUNLAP, KNOX**

GAULDEN, MARY E. See **CARLSON, J. GORDON**

GAY, BRIT B., Jr. See **BERGER, I. R.**

GEFTER, WILLIAM I. See **WEIS, WILLIAM**

GENITALS

- See also under names of genitals
 - radiation dosage to female genital tract during fluoroscopic procedures, H. Stephen Weens, J. Luther Clements and John H. Tolman, May, 745

CANCER

- fracture of femoral neck after x-ray therapy for carcinoma of female genital tract (ab), Heinz Kirchhoff and Gert Imholz, March, 475

GENITOURINARY TRACT. See Bladder; Kidneys; Ureters; Urethra; etc.

GERSHON-COHEN, J., INGLEBY, HELEN, and HERMEL, M. B.: Roentgenographic diagnosis of calcification in carcinoma of the breast (ab), April, 615

—**and KREMENS, VICTOR:** X-ray studies of the ileocecal valve in ileocecal tuberculosis, Feb., 251

—See **ORLOFF, T. L.**

—**SCHREAR, HARALD SKLAROFF, DAVID M., and BLUMBERG, NATHAN:** Dissolution of the intervertebral disk in the aged normal: the phantom nucleus pulposus, March, 383

GERSTEN, JOHN. See **MEANS, RUSSELL G.**

GETZOFF, PAUL, HIDALGO, JOHN, and MEYER, JOE: A syringe shield used in injecting radioactive gold (ab), June, 918

GEWANTER, A. P. See **DEMY, N. G.**

GHOSH, A., KASTNER, J., and WHYTE, G. N.: Gamma-ray output of radium (ab), April, 638

GIANT-CELL TUMOR. See Tumors, giant-cell

GILG, EYNAR: The influence of diphenhydramine (Benadryl) on the side-effects of Diodone in urography (ab), Feb., 303

GILJE, OSCAR. See **ENGESST, ARNE**

GILL, JOHN J. See **DEUTSCHBERGER, OTTO**

GILLFILLAN, RUTHERFORD. See **STEINBACH, HOWARD L.**

GIRDANY, BERTRAM R.: Peptic ulcer in childhood (ab), April, 619

GLASSES

- wide-angle trifocal eyeglasses for radiologists, D. Alan Sampson, Feb., 255

GLAUSER, FRANK: Studies on intrahepatic arterial circulation (ab), Jan., 139

GLAZER, ISRAEL, and ADLERSBERG, DAVID: Volvulus of the colon: a complication of sprue (ab), April, 621

GLIOMA. See Brain, tumors

GLOAGUEN, A. See **ROYER, J.**

GLOBULIN. See Blood, proteins

GLYCOLYSIS

- experimental acute radiodermatitis following beta irradiation. IV. Changes in respiration and glycolysis (ab), C. C. Lushbaugh and D. B. Hale, June, 919

GOETSCH, CARL. See **BERLIN, NATHANIEL I.**

GOETZ, R. H., and NELLEN, MAURICE: Idiopathic dilatation of the pulmonary artery (ab), March, 450

GOFMAN, JOHN W. See **HEWITT, JOHN E.**

GOITER

- See also Goiter, Exophthalmic; Thyroid
 - radioactive-iodine studies in non-endemic goitrous cretinism (ab), E. M. McGirr and James H. Hutchison, April, 636

GOITER, EXOPHTHALMIC

- progressive exophthalmos following thyroidectomy cured by irradiation of cerebral centers; case, A. Tevnik Berkman, March, 406

GOLD, RADIOACTIVE. See Radioactivity

GOLDBLITH, SAMUELA. See **DAVISON, SOL**

GOLDEN, G. N., and RICHARDS, H. G. H.: Xanthogranulomatous disease of bone with polyarthritides. Report of two cases (ab), March, 457

GOLDEN R. See **TOCHILIN, E.**

GOLDENBERG, RAPHAEL R.: Diagnostic problems in herniated intervertebral disk (ab), Feb., 296

GOLDMAN, ALFRED. See **SHUFORD, WADE H.**

GOMBERG, HENRY J. See **GOULD, S. E.**

GOMBERT, H.-J.: Clinical and roentgenologic picture of chronic pulmonary toxoplasmosis (ab), April, 609

—**LAUX, H., and WINGUTH, H.:** Roentgenologic and clinical aspects of lung resection (operability and the postoperative course) (ab), June, 895

GONG, J. K. See **COHN, S. H.**

GONSHERY, LEON, MARSTON, ROBERT Q., and SMITH, WILLIE, W.: Naturally occurring infections in untreated and streptomycin-treated x-irradiated mice (ab), Jan., 160

—See **MARSTON, ROBERT Q.**

GORDON, I. See **HODSON, C. J.**

GORIDIS, D. D. See **LUDWIG, H.**

GORTON, GUNNAR: Post-irradiative prophylactic extraperitoneal lymphadenectomy in carcinoma of the uterine cervix (ab), Jan., 151

GOTTLIEB, A. M., BAER, L. J., and JORDAN, PRESCOTT, Jr.: Mediastinal lipoma simulating cardiac enlargement (ab), April, 610

GOULD, S. E., VAN DYKE, JAMES G., and GOMBERG, HENRY J.: Effect of x-rays on *Trichina* larvae (ab), Jan., 162

GOULD, WILBUR J. See **MAIER, HERBERT C.**

GOUNARIS, ISSIDORE G. See **APOSTOLOKIS, GEORGES**

GOWEN, G. HOWARD: Detection of cardiac abnormalities by mass chest x-ray surveys (ab), Feb., 288

GRAHAM, JOHN B. See **GRAHAM, RUTH M.**

GRAHAM, RUTH M., and GRAHAM, JOHN B.: A cellular index of sensitivity to ionizing radiation. The sensitization response (ab), Feb., 317

GRANONE, F.: Duodenal herniation of the gastric mucosa (ab), Feb., 293

GRANT, ROALD A. See **STOREY, CLIFFORD F.**

GRANULOMA

—eosinophilic. See Bones, tumors

—xanthogranuloma. See Xanthoma

GRAPHITE. See Pneumoconiosis

GRASSER, C. H.: Roentgen studies of two cases of primary retinoid sarcoma of the stomach (ab), June, 901

GRAUL, E. H.: Roentgen therapy of female beard (ab), May, 793

GRECO, ROBERT. See **LOVE, JESSHILL**

GREEN, D. T., ERRINGTON, R. F., BOYD, F. C., and HOPKINS, N. J.: Production of multicentric gamma-ray teletherapy sources (ab), March, 472

GREENBERGER, EDW. D.: Radiology in a small community, Jan., 88

GREENING, ROY R., and PENDERGRASS, EUGENE P.: Postmortem roentgenography with particular emphasis upon the lung, May, 720

GREENLEE, R. G. See **SEEDORF, E. E.**

GRÉGOIRE, A. See **MASY, S.**

GREGOR, Z., and KOVÁROVÁ, M.: Contribution to congenital syphilis (ab), March, 460

GRENAU, MARIE M. See **SMITH, WILLIE W.**

GREULICH, WILLIAM W., CRIMSON, CATHERINE S., and TURNER, MARGARET L.: The physical growth and development of children who survived the atomic bombing of Hiroshima or Nagasaki (ab), June, 921

GRIFFITH, GEORGE C. See **JACOBSON, GEORGE**

GRIMES, ORVILLE F. See **BINKLEY, FREDERICK M.**

GRIMMETT, LEONARD G., FLETCHER, GILBERT H., and MOORE, E. B.: An improved light localizer for x-ray therapy, April, 589

GROSS, ROBERT J. See **ROSZA, STEPHEN**

GROSS, T. A.: Kartagener's triad. Report of two cases, March, 347

GROSSMAN, M. I. See **FOX, BENUM W.**

GROSSMANN, MARIA E.: Placentography. Symposium. I. Direct placentography (ab), June, 908

GROVES, L. E. See **CRILE, GEORGE, Jr.**

GROW, JOHN B. See **ZIMMERMAN, JACOB**

GROWTH

See also Bones; Face

- influence of roentgen rays upon development of mouse by local irradiation of some parts of body (ab), V. V. Brunst and Frank H. J. Figge, Feb., 319

—physical growth and development of children who survived atomic bombing of Hiroshima or Nagasaki (ab), William W. Greulich et al, June, 921

GRUZHIT, CARL. See **BASSETT, ROBERT C.**

GUNZ, F. W.: Bone marrow changes in patients with chronic leukemia treated by splenic x-irradiation. Preliminary report (ab), June, 921

GURDJIAN, E. S. See **MARTIN, F. A.**

GUYTON, DONALD H. See **MERCER, ROBERT D.**

GVOZDANOVIC, V., HAUPTMANN, E., NAJMAN, E., and OBERHOFER, B.: Percutaneous splenic venography (ab), May, 788

—**and RIESSNER, D.:** Angiographic studies in the problem of brain revascularization (ab), June, 890

H

HAAS, LEWIS L.: Osteitis of the sphenoid sinus (ab), Feb., 283

—See **ARNOLD, A.**

—**LAUGHLIN, JOHN S., and HARVEY, ROGER A.:** Biological effectiveness of high-speed electron beam in man, June, 845

HABENULA. See Pineal Gland

HAHN, P. F., and CAROTHERS, E. L.: Lymphatic drainage following intrabronchial instillation of silver-coated radioactive gold colloids in therapeutic quantities (ab), Jan., 155

HAINES, GERALD. See **RITCHIE, WALLACE P.**

HAIR

- roentgen therapy of female beard (ab), E. H. Graul, May, 793

- HALE, D. B. See LUSHBAUGH, C. C.
- HALE, WILLIAM M., and STONER, RICHARD D.: The effect of cobalt-60 gamma radiation on passive immunity (ab), Feb., 316
- HALPERIN, PHILLIP H., KENT, BELA, and RUBIN, SIDNEY: Volvulus of small intestine complicating pregnancy. Report of a case (ab), May, 778
- HAMARTOMA. See Tumors, hamartoma
- HAMBY, WALLACE B.: Aneurysmal origin of nonfatal subarachnoid hemorrhage. An angiographic survey of 53 cases (ab), Jan., 126
- HAMILTON, H. A. R. See MacKENZIE, IAN
- HAMLIN, L. E.: Anthracosis occurring in a foundry employee (ab), March, 447
- HAMM, FRANK C., and HARLIN, HARRISON C.: Perirenal insufflation with arteriography (ab), June, 910
- See ROTHFELD, SAMUEL H.
- HAMMER, JOHN M., VISSCHER, FRANK, and HILL, EDWARD J.: Experimental gastrojejunal ulcers produced by reversing the duodenum (ab), April, 619
- HAMPEL, K. See ZDANSKY, E.
- HAMSA, W. R., and CAMPBELL, L. S.: Giant-cell tumor of the spine. A report of two cases (ab), Feb., 298
- Osteochondritis deformans coxae juvenilis. Familial demonstration (ab), May, 782
- HANSELIN, JOSEPH. See BARR, JOSEPH S.
- HANSARD, SAM L., and COMAR, C. L.: Radioisotope procedures with laboratory animals (ab), June, 919
- HARE, HUGH F. See TRUMP, JOHN G.
- HARLAN, T. R. See DAVIDSON, GEORGE
- HARLEY, JOHN H.: Sampling and measurement of airborne daughter products of radon (ab), June, 922
- HARLIN, HARRISON C. See HAMM, FRANK C.
- See ROTHFELD, SAMUEL H.
- HARPER, JAMES G. M. See LERMAN, FRED
- HARPER, R. A. KEMP. See CULLINAN, EDWARD R.
- HARRINGTON, NYRA G. See CARLSON, J. GORDON
- HARRIS, W. B., LEVINE, H. D., and EISENBUD, M.: Field equipment for the collection and evaluation of toxic and radioactive contaminants (ab), May, 799
- HARRISON, CLINTON R., and LUTTRELL, CHARLES: Persistent carotid-basilar anastomosis. Three arteriographically demonstrated cases with one anatomical specimen (ab), March, 443
- HART, F. DUDLEY: Ankylosing spondylitis (ab), June, 905
- HARVARD, MARVIN: Renal angiography (ab), June, 910
- HARVEY, ROGER A.: Observations in atomic medicine. The Carman Lecture, April, 479
- See ARNOLD, A.
- See HAAS, LEWIS L.
- See WATSMAN, HARRY A.
- HASNER, E., JACOBSEN, H. H., SCHALIMTZKE, M., and SNORRASON, E.: Lumbosacral transitional vertebrae. A clinical and roentgenologic study of 400 cases of low back pain (ab), Jan., 141
- HAUBRICH, R.: Clinical and theoretical considerations of plate-like atelectasis (ab), May, 768
- Esophageal ulcer with severe kyphoscoliosis (ab), Feb., 291
- and SCHULER, B.: The lung structure in roentgenograms of rare pneumoconioses (ab), Jan., 129
- and THURN, P.: Pneumoretroperitoneum in tumors of the adrenals (ab), April, 629
- HAUKOHL, ROBERT S. See MELAMED, ABRAHAM
- HAUPTMANN, E. See GVOZDANOVIC, V.
- HAWKINS, G. KENNETH, MARGOLIN, S., and THOMPSON, JOHN J.: Gastric emptying time: Comparative studies with placebos, Prantal and Banthine (ab), April, 617
- HAYBITTLE, J. L. See FREUNDLICH, H. F.
- HAYES, J. DUTNEY. See WILSON, RICHARD G.
- HAYES, THOMAS L. See HEWITT, JOHN E.
- HEACOCK, C. H., and CARA, D. J., Jr.: Radiation therapy of pancreatitis, May, 654
- HEAD
- See also Cranium
- absorption of x-rays by tissues of head and neck, M. G. Wheatcroft and J. E. Morgan, March, 423
- direct opacifying injections into venous system of head (ab), H. Fischgold et al., June, 890
- HEART
- See also Cardiovascular System; Ductus Arteriosus; Pericardium; Thrombosis, cardiac
- cardiac involvement in malignant lymphoma (ab), J. D. N. Nabarro, May, 702
- uptake of P^{32} by cardiac muscle in vivo (ab), Julian B. Marsh et al., March, 475
- abnormalities
- angiocardigram in Fallot's tetralogy (ab), James B. Lowe, April, 614
- angiocardigram in congenital disease correlated with clinical and autopsy findings: 5-year clinical and pathological study of 34 cases in infants and young children out of series of 1100 patients, and 425 angiocardigrams (ab), Benjamin M. Gasul et al., Feb., 288
- atrial septal defects in children: an angiocardigraphic study (ab), John Lind and Carl Wegelius, April, 612
- correlation of upper lobe vascularization with certain congenital intracardiac shunts, N. G. Demy and A. P. Gewanter, March, 329
- detection of abnormalities by mass chest x-ray surveys (ab), G. Howard Gowen, Feb., 288
- endocardial fibroelastosis: unusual case with impaired ability to fabricate serum proteins (ab), Ben E. Katz and Forrest H. Adams, May, 773
- persistent truncus arteriosus; 2 cases with right aortic arch (ab), Richard D. Rowe and Peter Vlad, June, 899
- pulmonary circulation in diagnosis of congenital disease (ab), Sumner N. Marder et al., Jan., 133
- tetralogy of Fallot with unilateral pulmonary atresia: a clinically diagnosable and surgically significant variant (ab), Alexander S. Nadas et al., April, 614
- catheterization
- report of Committee (of American Heart Association) on Cardiac Catheterization and Angiocardiography (ab), Andre Cournaud, Chairman, March, 449
- size of heart chambers determined by cardiac catheterization (ab), A. Schaefer and P. Thurn, May, 771
- dilatation
- pulmonary fibrosis and cor pulmonale in sarcoidosis, James J. McCort and Peter J. Pare, April, 496
- diseases
- beriberi heart disease (ab), Aaron B. Benchimol and Paul Schlesinger, June, 899
- discovered on chest microfilms (ab), R. V. Slattery, May, 772
- primary myocardial disease in infancy and childhood (ab), Harold D. Rosenbaum et al., May, 772
- radioiodine in treatment of advanced disease: end results in 100 patients (ab), Henry L. Jaffe et al., Jan., 154
- electrocardiography
- fluorodensography with radiopaque substance. New method for hemodynamic investigation (ab), Gustavo Moros G. et al., March, 448
- hypertrophy
- mediastinal lipoma simulating cardiac enlargement (ab), A. M. Gottlieb et al., April, 610
- insufficiency
- heart in I^{131} induced myxedema: comparison of roentgenographic and electrocardiographic findings before and after induction of myxedema (ab), George S. Kurland et al., June, 898
- localized interlobar effusion in congestive heart failure (ab), William Weiss et al., April, 612
- localized azygos fissure effusion in cardiac failure (ab), Robert L. Friedman, Jan., 133
- pericardial effusion associated with myxedema (ab), Paul A. Marks and Betty S. Roof, June, 898
- roentgenography. See also other subheads under Heart
- caval reflexes in angiocardiology and dynamics of right atrium (ab), Christian Hedman et al., Feb., 290
- contrast media for kidneys, heart and vessels, and their toxicity (ab), Carl Sandstrom, Feb., 303
- marginal shadow sign of heart (ab), H. Eck, Jan., 133
- radiologic appearances of heart, esophagus, and lungs in funnel chest deformity (ab), Nils P. G. Edling, Feb., 288
- size
- calculation of size by means of transverse diameter sum (ab), H. Ludwig and D. D. Goridis, June, 898
- valves. See also Aortic Valve; Mitral Valve; Pulmonary Valve; Tricuspid Valve
- contribution to topography of cardiac orifices and their interrelationship: opacification of coronary vessels (ab), Georges Apostolakis and Issidore G. Gounaris, May, 772
- valvular stenosis as cause of death in surgically treated coarctation of aorta (ab), George Jacobson et al., April, 614
- HEATLY, CLYDE A.: Primary plasma cell tumors of the upper air passages with particular reference to involvement of the maxillary sinus (ab), April, 631
- HEDENBERG, I., ENGFELDT, B., and ENGSTRÖM, A.: X-ray absorption and diffraction studies on experimental vesical calculi (ab), Jan., 147
- HEDMAN, CHRISTIAN, LIND, JOHN, and WEGELIUS, CARL: Caval reflexes in angiocardiology and the dynamics of the right atrium (ab), Feb., 290
- HEDVALL, ERIK: "Initial foci," a special group of minimal tuberculosis. Prognosis and treatment (ab), June, 896
- HEINZ, W. See WORTH, G.
- HEISER, SAUL, and SWYER, ALFRED J.: Myelography in spinal metastases, May, 695
- See STRULLY, KENNETH J.
- HEITMANN, KENNETH A. See JACOBSON, GEORGE
- HELICOID UTERUS. See Uterus
- HEMANGIOENDOTHELIOMA. See Tumors, angioendothelioma
- HEMANGIOMA. See Tumors, angioma
- HEMATOMA. See Lungs
- HEMIPLEGIA
- temporary hemiplegia from cerebral injection of Diodrast during catheter aortography; 2 cases (ab), E. Converse Peirce, 2nd, Jan., 126
- HEMOCHROMATOSIS
- absorption of iron. Radioiron studies in idiopathic hemochromatosis, malnutritional cytosiderosis, and transfusional hemosiderosis (ab), T. H. Bothwell et al., April, 638
- HEMOENCEPHALIC BARRIER
- effect of contrast media on blood-brain barrier (ab), Robert C. Bassett et al., Jan., 126
- studies on blood-brain barrier with radioactive phosphorus. III. Embryonic development of barrier (ab), Louis Bakay, May, 795
- temporary hemiplegia from cerebral injection of Diodrast during catheter aortography (interference with barrier by Diodrast); 2 cases (ab), E. Converse Peirce, 2nd, Jan., 126

HEMOPOIETIC SYSTEM

- See Bones, marrow; Spleen
- biological studies with arsenic⁷⁶. IV. Histopathologic effect of arsenic⁷⁶ upon hematopoietic tissues of patients with leukemia (ab), Matthew Block et al, Feb., 316
- hematologic studies of irradiated survivors in Hiroshima, Japan (ab), Yoshimichi Yamasawa, Jan., 159

HEMORRHAGE. See Blood, platelets; Brain; Gastrointestinal Tract; Intestines; Meninges; Peptic Ulcer; Uterus**HEMOSIDEROSIS**

- See also Hemochromatosis
- idiopathic juvenile pulmonary hemosiderosis (ab), C. J. Hodson et al, May, 770
- idiopathic pulmonary hemosiderosis, Felix G. Fleischner and Arnold L. Berenberg, April, 522

HENDRICKS, CHARLES H. See MORTON, JOSEPH L.
HENDRON, JOHN A. See RUSHMER, ROBERT F.
HENSCHKE, ULRICH K., JAMES, ARTHUR G., and MYERS, WILLIAM G.: Radiogold seeds for cancer therapy (ab), March, 473**HEREDITY**

- See also Familial Conditions
- osteomatosis (leontiasis ossea): hereditary disease of membranous bone formation associated in one family with polyposis of colon, Henry P. Plenk and Eldon J. Gardner, June, 830
- pulmonary arteriovenous fistula associated with hereditary hemorrhagic telangiectasis: report of their occurrence in father and son (ab), John R. Tobin, Jr., and Thomas C. Wilder, Feb., 286

HERMAPHRODITISM

- female pseudohermaphroditism; case proved roentgenologically (ab), Bertram Levin et al, April, 626
- roentgen examination for differentiation of simple hypospadias from hypospadias associated with hermaphroditism (ab), E. Schumann, March, 464

HERMEL, M. B. See GERSHON-COHEN, J.**HERNIA**

- diaphragmatic
 - diagnosis and management of esophageal hiatus hernia (ab), Joseph Shaiken, Jan., 139
 - herniation of right diaphragm secondary to trauma (ab), Ernest C. Strode and Charles A. Vance, March, 450
 - reflections on hiatus hernia and related problems (ed), Alan S. Johnstone, May, 750
 - right-sided traumatic hernia simulating pleural effusion (ab), S. M. Unger, Jan., 140
 - strangulated hiatus hernia (ab), G. A. P. Hurley, May, 774
 - upside-down stomach in parahiatal hernia (ab), Richard Flynn, April, 619
 - volvulus of lobe of lung as complication of hernia; case (ab), Herbert T. Ransdell, Jr., and Robert G. Ellison, Feb., 284
- internal
 - paraduodenal hernias (ab), Philip B. Parsons, Feb., 294
 - paraduodenal. See Hernia, internal

HERTZBERG, ARTHUR D. See LERMAN, FRED**HERZOG, H., and PULVER, W.:** Pseudosyphilitic (Wassermann-positive) virus pneumonia. Experiences with 37 cases from 1940 to 1952 (ab), Jan., 128**HESS, P., and FISCHER, B.:** Radiation therapy of hemangioma (ab), May, 791**HESTON, W. E., LORENZ, EGON, and DERINGER, MARGARET K.:** Occurrence of pulmonary tumors in strain A mice following total-body x-radiation and injection of nitrogen mustard (ab), May, 799**HEWITT, JOHN E., HAYES, THOMAS L., GOFMAN, JOHN W., JONES, HARDIN B., and PIERCE, FRANK T.:** Effects of total body irradiation upon lipoprotein metabolism (ab), Jan., 161**HEYL, HENRY L.** See FOLTZ, ELTON L.
HEYMAN, SEYMOUR, KESSEL, I., JACKSON, HARRIS, JAVETT, S. N., and BRAUDO, J. L.: Septic arthritis and osteomyelitis in infancy (ab), March, 458**HIBERNOMA.** See Tumors, lipoma**HIDALGO, JOHN.** See GETZOFF, PAUL
HIEBERT, P. E., and KUBIN, DORIS A.: Radiographic diagnosis of placenta praevia (ab), Jan., 146**HILL, EDWARD J.** See HAMMER, JOHN M.**HILL, IAN M.:** A method of angiocardiology (ab), Jan., 134**HINKEL, CHARLES L.:** Gallbladder disease and the radiologist (ab), April, 621**HINMAN, FRANK, Jr.:** A simple injector for aortography and intravenous angiography (ab), June, 910**MILLER, GERALD M., NICKEL, ELTON, and MILLER, EARL R.:** Vesical physiology demonstrated by cineradiography and serial roentgenography. May, 713**HIP**

- See also Osteochondritis
- osteoarthritis (ab), Franklyn Stonham, April, 623
- osteoporosis as early symptom of osteochondritis deformans coxae juvenilis (Perthes) (ab), F. Wirz, Feb., 299

roentgenography

- horizontal lateral roentgenography in children; preliminary report (ab), Herbert Laage et al, Feb., 300

HIROSHIMA. See Atomic Bomb**HISTIOCYTES.** See Schüller-Christian Syndrome**HISTOPLASMOSIS**

- histoplasmin and tuberculin study of psychiatric patients having abnormal chest roentgenograms (ab), Millard A. Troxell, Jan., 128

- pulmonary histoplasmosis; study of 22 cases with identification of H. capsulatum in resected lesions (ab), Thomas F. Puckett, Feb., 285

- solitary pulmonary focus—carcinomatous or otherwise, with particular reference to histoplasmosis (ab), W. A. Jones, March, 446

- two cases (ab), Robert Charr, Jan., 127
- with particular attention to histoplasmosis of lungs (ab), A. Jakob and E. Krusch, Jan., 127

HOARE, R. D.: Arteriovenous aneurysm of the posterior fossa (ab), June, 889**HODES, PHILIP J., CAMPOY, FRANCISCO, RIGGS, HELEN E., and BLY, PAUL:** Cerebral angiography. Fundamentals in anatomy and physiology (ab), May, 764**PENDERGRASS, EUGENE P., and WINSTON, NORMAN J.:** Pancreatic, ductal, and vaterian neoplasms: their roentgen manifestations, Jan., 1**HODGES, HAZEL W.** See WATROUS, R. M.**HODGKIN'S DISEASE**

- See also Tumors, lymphoma
- irradiation therapy, Charles M. Nice and K. Wilhelm Stenstrom, May, 641

HODGKINSON, C. P.: Relationships of the female urethra and bladder in urinary stress incontinence (ab), Jan., 146**HODSON, C. J., FRANCE, N. E., and GORDON, I.:** Idiopathic juvenile pulmonary haemosiderosis (ab), May, 770**HOFFMAN, M. C.:** Radioactive iodine-labeled fat (ab), Feb., 314**HOFFMAN, THEO.** See ROBERT, FRANÇOIS**HOLDEN, F. R.** See SKOW, R. K.**HOLLISTER, AUGUST C., Jr.** See DUNLAP, KNOX**HOLMAN, COLIN B.** See OLSEN, ARTHUR M.**HOLMAN, W. P.** See SCOTT, R. KAYE**HOLMES, R. BRIAN:** Intramural extramucosal tumors of the stomach (ab), April, 617**HOLT, JOHN F.** See SINGLETON, EDWARD B.**HOLYI, YURYI, and POCH, ROBERT:** Deformity of the bronchi (ab), March, 445**HOLYOKE, JOHN B.** See FOLTZ, ELTON L.**HONIG, EDWARD L., DUBILIER, WILLIAM, Jr., and STEINBERG, ISRAEL:** Significance of the buckled innominate artery (ab), May, 788**HOOGSTRATEN, JAN.** See CHILDE, ARTHUR E.**HOPKINS, N. J.** See GREEN, D. T.**HORN, ROBERT C., Jr.** See RAVDIN, I. S.**HORNE, KENNETH W.** See TRUMP, JOHN G.**HORNKIEWYTSC, TH., and STENDER, H. ST.:** Intravenous cholangiography (ab), June, 904**HORRAX, GILBERT.** See POPPEN, JAMES L.**HORWITZ, ORVILLE, and ZINSSER, HARRY F., JR.:** Subclavian vein obstruction. Report of a case studied by venography and relieved by surgery (ab), Jan., 149**HOPEAU, MME.** See ROCHE, G.**HOVENANIAN, MICHAEL S.** See CHAMBERLIN, HAROLD A.**HOWLAND, JOE W.** See FURTH, FRANK W.**HUBER, K., and STÖSSEL, H. U.:** Intravenous cholangiography with Biligradin (ab), June, 905**HUDSON, GRANVILLE W.** See PEARSON, W. N.**HUIZINGA, EELCO:** Foreign bodies and roentgen examination of perforation of the esophagus (ab), Jan., 135**HULL, JOHN G.** See McDANIEL, SHAW**HULTBERG, SVEN:** Local enzymatic treatment of radiation necrosis of the skin (ab), Feb., 320**HUMERUS**

- aseptic necrosis of capitulum humeri (ab), C. Buetti, June, 907
- supracondylar process, Charles E. Parkinson, April, 556

HUMPHREYS, G. H., II. See TOTTON, R. S.**HUNGATE, CARROLL P.:** Miskonceptions concerning nuclear explosions (ab), April, 640**HURLEY, G. A. P.:** Strangulated hiatus hernia (ab), May, 774**HURST, ALLAN.** See ZIMMERMAN, JACOB**HURST, W. M.:** Monitoring of liquids for radioactivity (ab), June, 918**HURT, R. L.:** Osteopathia striata—Voorhoeve's disease. Report of a case presenting the features of osteopathia striata and osteopetrosis (ab), Jan., 140**HUTCHISON, JAMES H.** See MCGIRR, E. M.**HYDATID DISEASE.** See Echinococcosis; Kidneys**HYDE, GRACE M.** See BERLIN, NATHANIEL I.**HYDERGINE.** See CCK**HYDROCHLORIC ACID.** See Stomach, inflammation**diHYDROERGOTAMINE.** See Ergot Preparations**HYDROTHORAX**

- mobile floating fibrin bulla in course of hydropneumothorax (ab), G. Roche et al, Jan., 131

HYPEROSTOSIS. See Bones, pathology**HYPEROSTOSIS, INFANTILE CORTICAL.** See Bones, pathology**HYPERTENSION.** See Blood Pressure, high; Portal Vein**HYPERTHYROIDISM.** See Thyroid**HYPERTRICHOSIS.** See Hair**HYPOPHARYNX.** See Pharynx**HYPOPHYSIS.** See Pituitary Body**HYOSPADIAS**

- roentgen examination for differentiation of simple hypospadias from hypospadias associated with hermaphroditism (ab), E. Schumann, March, 464

HYSTEOSALPINGOGRAPHY. See Fallopian Tubes

ILEOCECAL VALVE

—x-ray studies of valve in ileocecal tuberculosis, J. Gershon-Cohen and Victor Kremens, Feb., 251

ILEUM. See Intestines**ILEUS. See Intestines, obstruction****IMHOLZ, GERT. See KIRCHHOFF, HEINZ****IMMUNITY**

—effect of cobalt-60 gamma radiation on passive immunity (ab), William M. Hale and Richard D. Stoner, Feb., 316

INCONTINENCE. See Urine and Urination**INDUSTRY AND OCCUPATIONS**

—investigation into relationship between physiologically low leukocyte counts and sickness absence (ab), Frances M. Turner, June, 920

—diseases and poisoning. See also Bagassosis; Pneumoconiosis

—farmer's lung (ab), T. C. Studdert, April, 610

—periosteopathy of mother-of-pearl workers (ab), Antonio Runco and Roberto Bossi, May, 781

—respiratory disorders among welders (ab), Robert Charr May, 770

INFANTS. See Children; Infants, Newborn**INFANTS, NEWBORN**

—intestinal obstruction in newborn associated with faulty development of midgut and its mesentery; description of 3 cases (ab), R. Spencer, Jan., 138

INFARCTION. See Lungs**INFECTION**

—experimental infection and streptomycin treatment in irradiated mice (ab), Robert Q. Marston et al, Jan., 161

—naturally occurring infections in untreated and streptomycin-treated x-irradiated mice (ab), Leon Gonsheer et al, Jan., 160

—prophylactic antibiotic therapy in x-irradiated animals (ab), Willie W. Smith et al, Jan., 160

—radiation burns from diffraction apparatus simulating infections; cases (ab), R. M. Watrous et al, April, 638

INGELFINGER, FRANZ J., and KRAMER, PHILIP: Dysphagia produced by a contractile ring in the lower esophagus (ab), Jan., 135**INGLEBY, HELEN. See GERSHON-COHEN, J.****INTER-AMERICAN CONGRESS OF RADIOLOGY (Fifth).**

March, 430; May, 754

INTERNATIONAL CANCER CONGRESS (Sixth), Jan., 111**INTERNATIONAL CONGRESS OF RADIOLOGY (Seventh)**

—recommendations of International Commission on Radiological Units. Revised at Seventh International Congress of Radiology, Copenhagen, July 1953 (ed), Lauriston S. Taylor, Secretary, Jan., 106

INTESTINES

See also Colon; Digestive System; Duodenum; Gastrointestinal Tract

—roentgen therapy of small intestine (ab), S. di Rienzo, April, 634

—abnormalities. See Intestines, obstruction

—Crohn's disease involving stomach; 2 cases (ab), F. R. R. Martin and R. J. Carr, Jan., 136

—regional enteritis—its allergic aspects (ab), Albert H. Rowe et al, Feb., 293

diverticula

—intrauterine perforation of Meckel's diverticulum (ab), Stephen Rosza and Robert J. Gross, April, 621

—Meckel's diverticulum with intussusception, ulceration with hemorrhage, and ectopic gastric mucosa and pancreatic tissue (ab), Michael F. Koszalka (ab), April, 621

hemorrhage. See also Intestines, diverticula

—roentgen diagnosis of bleeding lesions of small intestine (ab), Andrew P. Dedick and Lois C. Collins, April, 620

motility

—action of Banthine on small intestine studied by rapid method (ab), Juan Nasio, April, 620

—disorders of motility of small bowel (following gastrectomy) (ab), Ian W. MacPhee, Feb., 293

obstruction. See also Intussusception

—in neonatal period (ab), George Davison and T. R. Harlan, Feb., 293

—in newborn associated with faulty development of midgut and its mesentery; 3 cases (ab), R. Spencer, Jan., 138

—of proximal jejunum following gastric resection and antecolic anastomosis; 3 cases (ab), John P. West, May, 777

—postoperative obstruction (ab), William S. McCune and John M. Keshishian, March, 454

—resulting from biliary calculi (gallstone ileus) (ab), Samuel Shore et al, Jan., 138

—roentgen diagnosis of gallstone ileus, Thomas W. Dorr March, 363

—with congenital absence of left diaphragm (ab), Robert T. Campbell, May, 777

perforation. See Intestines, diverticula**roentgenography. See also other subheads under intestines**

—radiologic aspects of small intestine in typhoid fever (ab), E. Chérigé et al, May, 778

tuberculosis

—roentgenologic and clinical observations of an atypical case (ab), Paul Ecey, May, 778

—x-ray studies of ileocecal valve in ileocecal tuberculosis, J. Gershon-Cohen and Victor Kremens, Feb., 251

tumors

—jejunal polyps and intussusception associated with abnormal

melanin pigmentation (ab), W. Glenn Young, Jr., April, 620

—melanin spots of lips, oral mucosa and digits associated with intestinal polyposis; case (ab), Lloyd F. Sherman and Robert J. Tenner, Jan., 139

ulcers. See Intestines, diverticula**volvulus**

—of colon: a complication of sprue (ab), Israel Glazer and David Adlersberg, April, 621

—of sigmoid (ab), Louis T. Gabriel et al, May, 778

—of small intestine complicating pregnancy; case (ab), Phillip H. Halperin et al, May, 778

INTUSSUSCEPTION

—in infants and children, with emphasis on recognition of cases with complications, Ji-Toong Ling, April, 505

—jejunal polyps and intussusception associated with abnormal melanin pigmentation (ab), W. Glenn Young, Jr., April, 620

—Meckel's diverticulum with intussusception, ulceration with hemorrhage, and ectopic gastric mucosa and pancreatic tissue (ab), Michael F. Koszalka, April, 621

—radiologist's role in intussusception (ed), April, 594

IODINE AND IODINE COMPOUNDS

See also Brain; Bronchi

—radioactive. See Radioactivity; Thyroid

toxicity

—contrast media for kidneys, heart and vessels and their toxicity (ab), Carl Sandström, Feb., 303

—effect of contrast media on blood-brain barrier (ab), Robert C. Bassett et al, Jan., 126

—influence of diphenhydramine (Benadryl) on side-effects of Diodone in urography (ab), Ejnar Gilg, Feb., 303

—permanent deposition of iodine contrast medium in wall of stomach (ab), Albert Bogsch, Jan., 137

—prevention of iodism in bronchography by use of ACTH; case (ab), Felix R. Park et al, June, 894

—reaction of pulmonary tissue to Lipiodol (ab), Warren L. Felton, II, March, 444

—temporary hemiplegia from cerebral injection of Diodrast during catheter aortography; 2 cases (ab), E. Converse Peirce, 2nd, Jan., 126

IODISM. See Iodine and Iodine Compounds**IRIDIUM, RADIOACTIVE. See Radioactivity****IRON, RADIOACTIVE. See Radioactivity****ISAACS, WILLIAM M. See BERG, HAROLD F.****ISCHEMIA. See Extremities****ISCHIUM**

—osteitis ischii and pubis following abdominoperineal resection for carcinoma of rectum; case, Alexander Lewitman and Louis Nathanson, March, 402

ISLAM, A. R. See SCHWARZ, GERHART S.**ISODOSE CURVES. See Radium****ISONIAZID**

—distribution and excretion of radioactive Isoniazid in tuberculous patients (ab), W. R. Barclay et al, Feb., 315

ISOTOPES. See Radioactivity**IVY, A. C. See FOX, BENUM W.****J**

JACK, EWEN A.: Naviculo-cuneiform fusion in the treatment of flat foot (ab), Jan., 145

JACKSON, HARRIS. See HEYMANN, SEYMOUR

JACOB, HARRY H. See SHORE, SAMUEL

JACOBS, J. BAY: The value of the lateral pelvic roentgenogram as an index of fetal maturity and type of maternal pelvis (ab), Feb., 302

JACOBS, LEWIS G., SMITH, JAMES K., and VAN HORN, PHILIP S.: Myelographic demonstration of cysts of spinal membranes, Feb., 215

JACOBSEN, H. H. See HASNER, E.

JACOBSON, BERTIL: Dichromatic absorption radiography. Dichromography (ab), April, 630

JACOBSON, GEORGE, COSBY, RICHARD S., GRIFFITH, GEORGE C., and MEYER, BERTRAND W.: Valvular stenosis as a cause of death in surgically treated coarctation of the aorta (ab), April, 614

—and HEITMANN, KENNETH A.: Cholangiography with a viscous, water-soluble contrast medium, Feb., 241

JACOBSON, LEON O. See BLOCK, MATTHEW

JACQUE, GUY. See TRUMP, JOHN G.

JAFFE, HENRY L., ROSENFELD, MAURICE H., POBIRS, FREDERICK W., and STUPPY, LAURENCE J.: Radiiodine in treatment of advanced heart disease. End results in one hundred patients (ab), Jan., 154

JAKOB, A., and KRISCH, E.: Histoplasmosis with particular attention to histoplasmosis of the lungs (ab), Jan., 127

JAMES, ARTHUR G. See HENSCHKE, ULRICH K.

JAMIESON, H. D.: A method of tumour localisation and field positioning in radiotherapy, Feb., 195

JAPHA, E. M.: The use of cobalt 60 in gamma-ray therapy (ab), March, 473

JAKES, WILLIAM E. See BOTSFORD, THOMAS W.

JARRETT, S. R. See BARRETT, T. F.

JARVIS, J. LUTHER, JENKINS, DALTON, SOSMAN, MERRILL C., and THORN, GEORGE W.: Roentgenologic observations in Addison's disease. A review of 120 cases, Jan., 16

JASINSKI, B. See WUHRMANN, F.

JAUNDICE

—percutaneous transhepatic cholangiography in diagnosis of obstructive jaundice (ab), A. W. Nurick et al, May, 780

- JAVERT, CARL T., and RASCOE, ROBERT R.:** Serous cystadenocarcinoma of the ovary. A review of 127 cases (ab), Feb., 309
- JAVETT, S. N.** See **HEYMANN, SEYMOUR**
- JAWS**
—arthropathies of temporomandibular joint; roentgenologic aspects (ab), A. A. de Lorimier, March, 459
—carcinoma of oral cavity and lower jaw (ab), S. P. Srivastava, May, 791
- JEJUNUM.** See **Intestines, tumors; Peptic Ulcer**
- JENKINS, DALTON.** See **JARVIS, I. LUTHER.**
- JENKINS, MELVIN E., and SCOTT, ROLAND B.:** Infantile cortical hyperostosis (Caffey-Smyth syndrome). Report of a case in a Negro infant (ab), March, 458
- JEWELL, F. C., and KLINE, JOHN R.:** The purged colon, March, 368
- JIDEJIAN, Y.:** Hydatid disease (ab), April, 630
- JODURON B.** See **Bronchi, roentgenography**
- JOELSON, JAMES J., PERSKY, LESTER, and ROSE, FREDERICK A.:** Radiographic diagnosis of tumors of the adrenal gland, April, 488
- JOFFE, SAMUEL M.** See **FRIEDMAN, PAUL S.**
- JOHANSON, CURT:** The cerebral phlebogram by carotid angiography in cases of central brain tumours (ab), June, 890
- JOHANSSON, SVEN A. E., and SKANSE, BENGT:** A photographic method of determining the distribution of radioactive material in vivo (ab), Feb., 313
- JOHNS, H. E., WHITMORE, G. F., WATSON, T. A., and UMBERG, F. H.:** A system of dosimetry for rotation therapy with typical rotation distributions (ab), March, 472
—See **FEDORUK, S. O.**
—See **WATSON, T. A.**
- JOINTS**
—See also **Arthritis; under names of joints, as Hip**
—double contrast visualization (ab), Leon O. Parker and Alfred A. de Lorimier, March, 455
- JONAS, AUGUST F.** See **YOUNG, HENRY A.**
- JONES, GEORGE H., MELENDY, OAKLEY A., and FLYNN, WILLIAM F.:** Spontaneous nephrooduodenal fistula. Review of the literature and report of a case (ab), April, 629
- JONES, HARDIN B.** See **HEWITT, JOHN E.**
—See **KELLY, LOLA S.**
- JONES, H. MORUS:** Neurilemmoma of bone (ab), May, 783
- JONES, IRA S., and REESE, A. B.:** Focal scleral necrosis. A late sequel of irradiation (ab), April, 639
- JONES, W. A.:** The solitary pulmonary focus—carcinomatous or otherwise, with particular reference to histoplasmosis (ab), March, 446
- JORDAN, PRESCOTT, Jr.** See **GOTTLIEB, A. M.**
- K**
- KAAE, SIGVARD:** Radiotherapy in cancer of the breast, with particular reference to the value of preoperative irradiation as a supplement to radical mastectomy. Analysis of 1418 new cases (ab), Feb., 307
- KÄMMERLING, FRIEDRICH K.:** Bile and contrast medium reflux into the pancreatic ducts (ab), April, 622
- KALMON, EDMOND H.:** Creeping eruption associated with transient pulmonary infiltrations, Feb., 222
- KAN, BILLY.** See **DAVISON, SOL**
- KANITZ, HELMUT R., PFANDER, FRIEDRICH, and POPPE, HANNO:** Experimental observations on local tumor therapy with radiogold (ab), May, 794
- KAPOSI'S ANGIOMATOSIS.** See **Tumors, angioma**
- KAREL, MARCUS.** See **DAVISON, SOL**
- KARG, R.** See **BONSE, G.**
- KARTAGENER'S TRIAD.** See **Bronchiectasis**
- KASTNER, J.** See **GHOSH, A.**
- KASUGA, KASUMI.** See **ACETO, JOSEPH N.**
- KATZ, BEN E., and ADAMS, FORREST H.:** Endocardial fibroelastosis. Report of unusual case with impaired ability to fabricate serum proteins (ab), May, 773
- KAUNTZE, RALPH.** See **CAMPBELL, MAURICE**
- KAYLOR, C. T.** See **VAN CLEAVE, C. D.**
- KEATING, D. R., and AMBERG, J. R.:** A source of potential error in the roentgen diagnosis of cervical ribs, May, 688
- KEATS, THEODORE E., and BAGNALL, WILLIAM S.:** Chronic idiopathic osteoarthritis, June, 841
- KEITH, JOHN D., NEILL, C. A., VLAD, PETER, ROWE, E. D., and CHUTE, A. L.:** Transposition of the great vessels (ab), April, 613
- KELHAM, GEOFFREY.** See **ERSKINE, JOHN P.**
- KELLY, HERBERT B.** See **LITTLE, ROBERT C.**
- KELLY, LOLA S., and JONES, HARDIN B.:** Influence of homologous tissue factors on DNA turnover and radiation protection (ab), Jan., 162
- KENIN, ABEL.** See **STEIN, FELIX**
- KENT, BELA.** See **HALPERIN, PHILLIP H.**
- KEPP, R. K.** See **CZECH, H.**
- KERMAN, HERBERT D.** See **ANDREWS, GOULD A.**
- KEROSENE**
—kerosene poisoning in young children, Joseph C. Foley, Nicholas B. Dreyer, A. Bradley Soule, Jr., and Ephraim Wolf, June, 817
- KERR, H. DABNEY, FLOCKS, R. H., ELKINS, H. B., and CULP, DAVID:** Treatment of moderately advanced carcinoma of the prostate with radioactive gold (ab), April, 637
- KESHISHIAN, JOHN M.** See **McCUNE, WILLIAM S.**
- KESSEL, I.** See **HEYMANN, SEYMOUR**
- KEYNES, R. D.** See **MAYNEORD, W. V.**
- KIDNEYS**
—See also **Dwarfism, renal**
—effect of x-ray to kidney on renal function of dog (ab) Mortimer L. Mendelsohn and Eduardo Caceres, March, 476
blood supply. See also **Aneurysm, renal; Arteries, renal**
—translumbar aortography in infants utilizing 70 per cent Urokon as contrast medium (ab), W. F. Melick et al, Jan., 149
—translumbar arteriography: survey of its uses (ab), Robert P. Schach, Jan., 150
- calcification**
—nephrocalcinosis associated with sarcoidosis: presentation and discussion of 7 cases, Charles N. Davidson, John M. Dennis, Eugene R. McNinch, James K. V. Wilson and Webster H. Brown, Feb., 203
—roentgenographic demonstration of histologically identifiable renal calcification, JD Mortensen, Archie H. Baggenstoss, Marschelle H. Power and David G. Pugh, May, 703
- cysts.** See also **Kidneys, echinococcosis**
—value of plain film in renal mass lesions (tumors and cysts), Alice Ettinger and Milton Elkin, March, 372
- echinococcosis**
—hydatid cyst; 2 cases (ab), E. R. Reay and G. L. Rolleston, March, 464
—renal echinococcus disease, I. R. Berger and G. T. Cowart, June, 832
- fistula.** See **Fistula**
- function**
—roentgenological aspects of renal function (ab), Hugh M. Wilson, Feb., 304
- roentgenography.** See also **Pyelography; other subheads under Kidneys**
—perirenal air insufflation by paracoccygeal method (ab), Samuel H. Rothfeld et al, March, 463
—presacral perirenal pneumography (ab), Laurence F. Tinkler, Feb., 304
—study of renal tract in carcinoma of cervix (ab), Ruth Dearing, Feb., 305
- tuberculosis**
—roentgenographic classification of tuberculous lesions (ab), John K. Lattimer, March, 463
- tumors**
—clinical diagnosis of tumors of adult renal parenchyma (ab), Edgar Burns, June, 911
—value of plain film in renal mass lesions (tumors and cysts), Alice Ettinger and Milton Elkin, March, 372
—Wilms' tumor in an adult; 10-year cure (ab), Geo. R. Livermore, June, 914
- KIMBALL, CECIL H.** See **BERREY, BEDFORD H.**
- KING, D. P.** See **STORAASLI, J. P.**
- KIRCHHOFF, HEINZ, and IMHOLZ, GERT:** Fractures of the femoral neck after x-ray therapy for carcinoma of the female genital tract (ab), March, 475
- KISIELESKI, WALTER E.** See **LISCO, HERMANN**
- KJELLMAN, LENNART:** A new instrument for hysterosalpingography (ab), May, 785
- KLEITSCH, W. P., and LAWTON, R. L.:** Transpyloric prolapse of gastric mucosa (ab), Jan., 138
- KLIGERMAN, MORTON M., ROSEN, ELAINE G., and QUIMBY, EDITH H.:** Rotation therapy techniques applicable to standard deep-x-ray machines, Feb., 183
- KLINE, JOHN R.** See **JEWELL, F. C.**
- KLUN, B.** See **LIESE, E.**
- KNAUS, WILLIAM E., CAMPOS, JOSEPH, and ROSE, WILLIAM:** Meigs' syndrome. Report of a case in a child (ab), April, 625
- KNEE**
—qualitative comparison between standard type of examination and tomography for certain intraosseous structural changes (ab), Folke Knutsson, Jan., 143
- KNISELEY, RALPH M., and ANDREWS, GOULD A.:** Pathological changes following intracavitary therapy with colloidal Au¹⁹⁸ (ab), Feb., 315
- See **ANDREWS, GOULD A.**
- KNOX, W. GRAHAM, and PARSONS, HERBERT:** Sympathectomy in chronic occlusive arterial disease (ab), March, 466
- KNUTSSON, FOLKE:** A qualitative comparison between the standard type of examination and tomography for certain intraosseous structural changes (ab), Jan., 143
- KOCH, RUD.:** Treatment of plantar warts (ab), May, 793
- KÖHLER, ROLF:** Investigations on backflow in retrograde pyelography. A roentgenological and clinical study (ab), Feb., 304
- KÖRBLER, J., FRANK, P., ŠKARICA, P., and BUHAČ, I.:** Radium treatment of cutaneous and lip cancer (ab), March, 467
- KOHL, DOUGLAS A.:** A multiple-counter system for isotope encephalometry (ab), June, 916
- KOLB, FELIX O.** See **STEINBACH, HOWARD L.**
- KOMESU, SENCHI.** See **BLOUNT, S. GILBERT, Jr.**
- KOREA**
—pulmonary paragonimiasis: review with case reports from Korea and Philippines (ab), Francisco T. Roque et al, April, 609

- KOSZALKA, MICHAEL F.:** Meckel's diverticulum with intussusception, ulceration with hemorrhage, and ectopic gastric mucosa and pancreatic tissue (ab), April, 621
- KOVÁROVÁ, M.** See GREGOR, Z.
- KOVNAT, MAURICE.** See REISS, JACK
- KRAININ, PHILIP:** Gastric ulcer with massive hemorrhage following use of Phenylbutazone. Report of a case (ab), March, 454
- KRAMER, PHILIP.** See INGELFINGER, FRANZ J.
- KREMENS, VICTOR.** See GERSHON-COHEN, J.
- KRISCH, E.** See JAKOB, A.
- KUBACKI, W. HOWARD.** See SARNAT, BERNARD G.
- KUBIN, DORIS A.** See HIEBERT, P. E.
- KURLAND, GEORGE S., SCHNECKLOTH, ROLAND E., and FREEDBERG, E. STONE:** The heart in iodine-induced myxedema. Comparison of the roentgenographic and electrocardiographic findings before and after the induction of myxedema (ab), June, 898
- KUSCHNER, MARVIN.** See WERMER, PAUL
- KYPHOSCOLIOSIS.** See Spine
- L**
- LAAGE, HERBERT, BARNETT, JAMES C., BRADY, JOHN M., DULLIGAN, PETER J., Jr., FETT, HERBERT C., Jr., GALLAGHER, THOMAS F., and SCHNEIDER, BERTRAM A.:** Horizontal lateral roentgenography of the hip in children. Preliminary report (ab), Feb., 300
- LABOR**
—See also Craniometry; Pelvis, measurement; Placenta
—hyperextension of fetal head in breech presentation (ab), Cary M. Dougherty et al., April, 627
- LACASSAGNE, A., and LOISELEUR, J.:** Chemical synthesis following the action of roentgen rays (ab), May, 799
Chemical synthesis following the action of physical peroxidase agents (roentgen rays, ultraviolet and ultrasonic rays) (ab), May, 799
- LaCORTE, SAMUEL.** See WEINER, JEROME J.
- LÄSER, S.** See ZUPPINGER, A.
- LAMINOGRAPHY.** See Body Section Roentgenography
- LAMSON, BALDWIN G.** See TULLIS, JOHN L.
- LANDIS, FRANCIS B.** See WEISEL, WILSON
- LANGLEY, RUSSELL A.:** Simple scheme for deriving x-ray skin-surface dose times (ab), March, 467
- LANIER, RAYMOND R.** See BLOUNT, S. GILBERT, Jr.
- LAPORTE, HENRI:** Chronic cholecystitis and Rokitsanski-Aschoff sinuses (ab), April, 622
- LAPORTE, A.** See CHERIGIE, E.
- LARSSON, L.-G.** See EGMARK, A.
- LARYNX**
—effect of roentgen irradiation on laryngotracheal lymph vessels (ab), Claudio Sberini and Ivo Orlandini, March, 476
—laminogram as aid in diagnosis of diseases (ab), LeRoy A. Schall et al., April, 606
- CANCER**
—carcinoma-in-situ (ab), Alden H. Miller and H. Russell Fisher, April, 632
- LASH, A. F.** See RUBOVITS, FRANK E.
- LAST, R. J., and TOMPSETT, D. H.:** Casts of the cerebral ventricles (ab), March, 442
- LATHAM, W. J.:** Hydatid disease. Part I (ab), May, 789
- LATTIMER, JOHN K.:** A roentgenographic classification of tuberculous lesions of the kidney (ab), March, 463
- LAUGHLIN, JOHN S.** See ARNOLD, A.
- See HAAS, LEWIS L.
- LAURENCE, W., and FRANKLIN, E. L.:** Calcifying enchondroma of long bones (ab), March, 462
- LAUX, H.** See GOMBERT, H. J.
- LAWRENCE, WALTER, Jr., NICKSON, JAMES J., and WARSHAW, LESLEY M.:** Roentgen rays and wound healing. An experimental study (ab), Jan., 162
- LAWTON, R. L.** See KLEITSCH, W. F.
- LAXAMANA, A. M.** See GARCIA, P. J.
- LAYNE, D. A., LOGUE, VALENTINE, MAYNEORD, W. V., McKISSOCK, WYLLIE, and SMITHERS, D. W.:** The treatment of cerebral gliomas with 24-million-volt x-rays (ab), Jan., 151
- LEBLOND, C. P.** See WILKINSON, G. W.
- LEE, J. GORDON.** See NOLAN, JOHN J.
- LEGER, L., GALLY, L., and ARVAY, N.:** Portal plebography by transportal parenchymatous splenic injection (ab), March, 466
- LEGERTON, C. W., Jr.** See TEXTER, E. C., Jr.
- LEHMAN, J. STAUFFER, and CURRY, JOSEPH L.:** Radiologic detection of a calcified thrombus within the left ventricle, March, 344
- LEINFELDER, P. J.** See ALTER, A. J.
- LEIOMYOMA.** See Tumors, myoma
- LEIOMYOSARCOMA.** See Sarcoma, myosarcoma
- LELL, WILLIAM A.:** Tracheopathia osteoplastica. Report of a case (ab), March, 448
- LEMMEIN, LLOYD J.** See RAND, ROBERT W.
- LENHARDT, HARRY F.** See BELL, LUTHER G.
- LEONTIASIS OSSIIUM**
—critical review, with report of 4 original cases (ab), John Evans, March, 456
—osteomatosis (leontiasis ossea): hereditary disease of membranous bone formation associated in one family with polyposis of colon, Henry P. Plenk and Eldon J. Gardner, June, 830
- LERMAN, FRED, HARPER, JAMES G. M., HERTZBERG, ARTHUR D., BERMAN, MICHAEL H., and LERMAN, PHILIP H.:** Presacral oxygen injection (ab), June, 910
- LERMAN, PHILIP H.** See LERMAN, FRED
- LeROY, G. V.** See BARCLAY, W. R.
- LETTERER-SIWE DISEASE.** See Reticuloendothelial System LEUKEMIA
—biological studies with arsenic⁷⁶. IV. Histopathologic effect of arsenic⁷⁶ upon hematopoietic tissues of patients with leukemia (ab), Matthew Block et al., Feb., 316
—bone marrow changes in patients with chronic leukemia treated by splenic x-irradiation; preliminary report (ab), F. W. Gunz, June, 921
—chronic myelogenous leukemia in children (ab), Jean V. Cooke, March, 471
—radiological evidence of growth in children with acute leukemia treated with folic acid antagonists, Harry A. Waisman and Roger A. Harvey, Jan., 61
- LEUKOCYTES**
—investigation into relationship between physiologically low leukocyte counts and sickness absence (ab), Frances M. Turner, June, 920
- LEVIN, BERTRAM, and RIGLER, LEO G.:** Rib notching following subclavian artery obstruction, May, 660
- RAMBAR, ALWIN C., and SHAPIRO, IRVING J.: Female pseudohermaphroditism. A report of a case proved roentgenologically (ab), April, 626
- LEVINE, H. D.** See HARRIS, W. B.
- LEVY, BERTRAM L.** See CHAIKEN, BERNARD H.
- LEWIS, CECIL, and ROGERS, LAMBERT:** The cervical aortic knuckle which resembles an aneurysm (ab), Feb., 290
- LEWIS, CHARLES L.:** Treatment of the meningeal system by means of radioactive colloidal gold and x-rays (ab), June, 914
- LEWITAN, ALEXANDER, and NATHANSON, LOUIS:** Osteitis ischii and pubis following abdominoperineal resection for carcinoma of the rectum. Case report, March, 402
- LIBAUDE, HENRY.** See ALBOT, GUY
- LIBBY, R. L.** See BARRETT, T. F.
- See STIRRETT, LLOYD A.
- LIBERSON, MIRIAM:** Soft tissue calcifications in cord lesions (ab), April, 625
- LICHSTEIN, JACOB and ASHER, LEONARD M.:** Benign prolapse of gastric mucosa. Clinical, roentgenologic, and gastroscopic study (ab), Jan., 137
- LICHTENSTEIN, LOUIS:** Histiocytosis X. Integration of eosinophilic granuloma of bone, "Letterer-Siwe disease" and "Schüller-Christian disease" as related manifestations of a single nosologic entity (ab), May, 782
- LIDL, H.:** X-ray determination of the decomposition of fat and its fate in the gastro-intestinal tract (ab), May, 773
- LIESE, E., MERTIN, W., FRUHMANN, G., and KLUN, B.:** Contribution to the early diagnosis of bronchial carcinoma by simple contrast demonstration of the bronchial tree (ab), June, 895
- LISS, G.:** Peculiar structural changes in the epiphyseal and metaphyseal regions in osteogenesis imperfecta tarda (ab), June, 906
- LILJA, BENGT:** Gastric block: a disturbance in gastric motive function (ab), March, 452
- LILJESTRAND, A.** See EGMARK, A.
- LIMBS.** See Extremities
- LIME.** See Calcium and Calcium Compounds
- LIN, PAUL, MURTAGH, FREDERICK, WYCKIS, HENRY, and SCOTT, MICHAEL:** Carotid angiography with Urokon, using the Chamberlain bi-plane stereoscopic angiographic unit. Report of one hundred cases (ab), May, 766
- LIND, JOHN, and WEGELIUS, CARL:** Atrial septal defects in children. An angiocardigraphic study (ab), April, 612
- See HEDMAN, CHRISTIAN
- See WEGELIUS, CARL
- LINDGREN, ERIK:** Technique of abdominal aortography (ab), Jan., 149
- LINDGREN, MARTIN:** Roentgen treatment of gliomata (ab), June, 913
- LINDSTROM, P. A.:** Ventricular displacement and electroencephalographic focus in multiple sclerosis (ab), May, 764
- LING, JI-TOONG:** Intussusception in infants and children with emphasis on the recognition of cases with complications, April, 505
- LIPIODOL.** See Iodine and Iodine Compounds
- LIPOMA.** See Tumors, lipoma
- LIPOPROTEINS**
—effects of total-body irradiation upon lipoprotein metabolism (ab), John E. Hewitt et al., Jan., 161
- LIPS**
—melanin spots of lips, oral mucosa and digits associated with intestinal polyposis; case (ab), Lloyd F. Sherman and Robert J. Tenner, Jan., 139
- CANCER**
—radium treatment of cutaneous and lip cancer (ab), J. Korbler et al., March, 467
- LIQUIDS**
—monitoring of liquids for radioactivity (ab), W. M. Hurst, June, 918
- LISA, JAMES R.** See NISSEN, R.
- LISCHI, GIANCARLO:** Radiological guidance in the surgical treatment of gastroduodenal ulcer (ab), May, 776

- LISCO, HERMANN, and KISIELESKI, WALTER E.:** The fate and pathologic effects of plutonium metal implanted into rabbits and rats (ab). Jan., 157
- LITTLE, ROBERT C., and KELLY, HERBERT B.:** Removal of radioactive gold colloid by the perfused mammalian liver (ab). March, 475
- LITTMAN, ARMAND.** See **FOX, BENUM W.**
- LIVER**
- benign non-traumatic stricture of left intrahepatic bile duct (ab). Jerome J. Weiner and Samuel LaCorte, May, 780
 - could a damaged liver be cause of lethal Pantocain intoxication (during bronchography)? (ab). H. Fietz, Jan., 132
 - cytological changes following roentgen irradiation of liver in mice (ab). M. E. Wilson and R. E. Stowell, Feb., 318
 - effect of therapeutic irradiation of carcinoma of cervix and liver function (ab). J. R. Snavely et al., May, 797
 - metabolism of ^{131}I -labeled thyroxine—studies with isolated, perfused rat liver (ab). F. N. Briggs et al., Jan., 157
 - removal of radioactive gold colloid by perfused mammalian liver (ab). Robert C. Little and Herbert B. Kelly, March, 475
 - roentgen demonstration of cirrhosis with fatty metamorphosis; case due to congenital fibrocystic disease. Howard L. Steinbach, Jackson T. Crane and Henry B. Bruyn, June, 858
 - use of colloidal Au^{198} for obtaining scintigrams of liver (ab). Eric T. Yuhl et al., Feb., 315
- abscess**
- distortion of pyelogram by extrarenal lesion: liver abscess distortion (ab). T. M. Yates, Jan., 147
- blood supply.** See **Arteries, hepatic**
- new technic for diagnosis of carcinoma metastatic to liver, preliminary report (ab). Lloyd A. Stirrett et al., Jan., 139
- LIVERMORE, GEO. R.:** Wilms's tumor in an adult: Report of a ten year cure (ab). June, 914
- LOCKE, G. BRIAN:** Carcinoma of the middle-lobe bronchus (ab). May, 769
- LODOWICK, GWILYM S.:** Bleeding from the upper gastrointestinal tract. A symposium. Part II. The role of the roentgenologist (ab). April, 616
- Dissecting aneurysms of the thoracic and abdominal aorta. Report of six cases, with a discussion of roentgenologic findings and pathologic changes (ab). April, 613
- LÖFGREN, F. OLOF:** Carotid angiography in the diagnosis of spontaneous intracerebral haemorrhage (ab). June, 890
- LÖHR, B.** See **WEBER, H. W.**
- LOEVINGER, ROBERT:** The dosimetry of beta radiations, Jan., 74
- LOGAN, ANDREW, and TURNER, RICHARD:** Mitral stenosis. Diagnosis and treatment (ab). March, 449
- LOGUE, VALENTINE.** See **LAYNE, D. A.**
- LOISELLEUR, J., CATINOT, L., and MORENNE, P.:** Action of reducing substances on the latent radiation effect in vitro (ab). May, 799
- See **LACASSAGNE, A.**
- and **SAUVAGE, M.:** Secondary evolution of molecules having a phenol radical, following roentgen irradiation (ab). May, 799
- LOMBARDI, GUIDO.** See **MASCHERPA, FERMO**
- LOONEY, WILLIAM B., and WOODRUFF, LOIS A.:** Investigation of radium deposition in human skeleton by gross and detailed autoradiography (ab). May, 797
- LOOSE, K. E.:** Operative and postoperative cholangiography and postoperative cholangiography by serial films (ab). Feb., 295
- LOOSER ZONES.** See **Bones, diseases**
- LORENZ, EGON.** See **BRYAN, W. RAY**
- See **HESTON, W. E.**
- LOVE, JESSHILL, SONNE, IRVIN H., Jr., and GRECO, ROBERT:** Management of carcinoma of the cervix (ab). April, 634
- LOVE, WILLIAM D., and BURCH, GEORGE E.:** A comparison of potassium 40 , rubidium 86 , and cesium 134 as tracers of potassium in the study of cation metabolism of human erythrocytes in vitro (ab). Jan., 157
- In vitro studies of aspects of the metabolism of sodium by human erythrocytes using sodium (ab). Jan., 158
- LOVINGOOD, CHARLES G., and PATTON, RICHARD:** Translumbar aortography as a diagnostic aid in localizing arterial emboli (ab). May, 787
- LOW-BEER, B. V. A., SCOFIELD, N. E., FELDSTED, E. T., and BROWN, R. F.:** Directed beam therapy. II. Multiple small field irradiation of the pituitary gland, pituitary tumors and other intracranial lesions (ab). April, 631
- LOWE, JAMES B.:** The angiocardigram in Fallot's tetralogy (ab). April, 614
- LUDWICK, RUSSELL W.** See **ROQUE, FRANCISCO T.**
- LUDWIG, H., and GORIDIS, D. D.:** Calculation of the size of the heart by means of the transverse diameter sum (ab). June, 898
- LUKAS, DANIEL S., DOTTER, CHARLES T., and STEINBERG, ISRAEL:** Agenesis of the lung and patent ductus arteriosus with reversal of flow. Case (ab). May, 767
- See **STEINBERG, ISRAEL**
- LUNGS**
- See also **Arteries, pulmonary; Bronchi; Bronchiectasis; Fistula, arteriovenous; Pleura**
 - clinical findings and anatomical changes in lungs following bronchography with Perabrodil BR (viscosity 60 per cent) (ab). H. W. Weber and B. Löhr, June, 894
 - concerning a case of pulmonary lymphangiectasis (ab). K. Reinhardt, March, 447
 - pulmonary paragonimiasis: review with case reports from Korea and Philippines (ab). Francisco T. Roque et al., April, 609
 - reaction of pulmonary tissue to Lipodol (ab). Warren L. Felton, II, March, 444
 - torsion of lung following thoracic trauma; case. E. H. Strateimer and J. W. Barry, May, 726
 - volvulus of lobe of lung as complication of diaphragmatic hernia; case (ab). Herbert T. Ransdell, Jr., and Robert G. Ellison, Feb., 284
- abnormalities**
- agenesis of lung and patent ductus arteriosus with reversal of flow; case (ab). Daniel S. Lukas et al., May, 767
 - agenesis of lung with vascular compression of tracheobronchial tree (ab). Herbert C. Maier and Wilbur J. Gould, April, 607
- blood supply.** See also **Fistula, arteriovenous**
- contribution of angiopneumography to some problems of pulmonary physiopathology (ab). Ricardo Rimini et al., March, 444
 - correlation of upper lobe vascularization with certain congenital intracardiac shunts. N. G. Demy and A. P. Gewanter, March, 329
 - pulmonary circulation in diagnosis of congenital heart disease (ab). Sumner N. Marder et al., Jan., 133
- calculi**
- clinical significance of cavernolithiasis (ab). Denton A. Cooley, Jan., 130
- cancer**
- cancer of lungs with metastases in lungs (ab). Nándor Rotkóczy, June, 895
 - cavernous metastatic carcinoma; 2 cases (ab). Emanuel Salzman et al., April, 608
 - facts and fancies (ab). D. W. Smithers, April, 633
 - lymphatic drainage following intrabronchial instillation of silver-coated radioactive gold colloids in therapeutic quantities (ab). P. F. Hahn and E. L. Carothers, Jan., 155
 - solitary pulmonary focus—carcinomatous or otherwise, with particular reference to histoplasmosis (ab). W. A. Jones, March, 446
- cavitation.** See **Lungs, calculi; Lungs, cancer; Lungs, infarction**
- collapse**
- bronchial obstruction with lobar atelectasis and emphysema in cystic fibrosis of pancreas (ab). Paul A. di Sant'Agnes, May, 771
 - clinical and theoretical considerations of plate-like atelectasis (ab). R. Haubrich, May, 768
- cysts**
- cyst formation in graphite pneumoconiosis (ab). H. Müller, June, 897
 - interlobar pulmonary sequestration (ab). Gladys Boyd, June, 896
 - lung cyst in infancy; case (ab). Doreen Murphy, March, 447
 - mucocoele of lung due to congenital obstruction of segmental bronchus; case. Relationship to congenital cystic disease of lung and to congenital bronchiectasis (ab). Beatty H. Ramsay, May, 767
- diseases.** See also **Bagassosis; Histoplasmosis; Osteoarthropathy; Pneumoconiosis; Pneumonia; etc.**
- bronchogenic carcinoma simulating benign pulmonary disease (ab). G. V. Brindley, Jr., March, 445
 - chronic pneumopathies and rheumatism (ab). E. Martin and G. H. Fallet, June, 897
 - farmer's lung (ab). T. C. Studdert, April, 610
 - idiopathic juvenile pulmonary hemosiderosis (ab). C. J. Hodson et al., May, 770
 - idiopathic pulmonary hemosiderosis, Felix G. Fleischner and Arnold L. Berenberg, April, 522
 - roentgen demonstration of cirrhosis of liver with fatty metamorphosis; case due to congenital fibrocystic disease. Howard L. Steinbach, Jackson T. Crane and Henry B. Bruyn, June, 858
 - solitary pulmonary focus—carcinomatous or otherwise, with particular reference to histoplasmosis (ab). W. A. Jones, March, 446
- fibrosis**
- pulmonary fibrosis and cor pulmonale in sarcoidosis, James J. McCort and Peter J. Pare, April, 496
- hematoma**
- pulmonary hematoma (ab). John M. Salyer et al., Feb., 285
- infarction**
- cavitation within bland infarcts (ab). Philip H. Southery and Bernard J. O'Loughlin, June, 897
 - roentgenographic aspects of complete and incomplete infarction (ab). Marcus J. Smith, March, 445
- mucocoele**
- due to congenital obstruction of segmental bronchus; case. Relationship to congenital cystic disease of lung and to congenital bronchiectasis (ab). Beatty H. Ramsay, May, 767
 - mucocoele, congenital bronchiectasis, and bronchiogenic cyst (ab). Beatty H. Ramsay and Francis X. Byron, April, 608
- mycosis.** See **Blastomycosis; Coccidioidomycosis; Histoplasmosis; Moniliasis; Toxoplasmosis**
- pathology**
- creeping eruption associated with transient pulmonary infiltrations, Edmond H. Kalmon, Feb., 222

LUNGS, pathology—cont.

- manifestations of scleroderma (ab), Wade H. Shuford et al, May, 771
- nature and genesis of pulmonary alterations in carbon tetrachloride poisoning (ab), William Umiker and John Pearce, Jan., 131
- prolonged pulmonary forms of Bornholm's disease (ab), A. Breton, Jan., 128
- roentgenography. See also other subheads under Lungs
 - coin lesions (ab), Clifford F. Storey et al, May, 769
 - coin lesions (ab), Harold G. Trimble, April, 607
 - histoplasmin and tuberculin study of psychiatric patients having abnormal chest roentgenograms (ab), Millard A. Troxell, Jan., 128
 - postmortem roentgenography with particular emphasis upon lung, Roy R. Greening and Eugene P. Pendergrass, May, 720
 - radiologic appearances of heart, esophagus, and lungs in funnel chest deformity (ab), Nils P. G. Edling, Feb., 288
- sequstration. See Lungs, cysts
- surgery. See also Bronchi, cancer
- roentgenology of operated lung (ab), S. di Rienzo, Feb., 284
- syphilis**
 - pseudosyphilitic (Wassermann-positive) virus pneumonia: experiences with 37 cases from 1940 to 1952 (ab), H. Herzog and W. Pulver, Jan., 128
 - pseudotumoral syphilis (ab), J. Royer and A. Gloaguen, Jan., 128
- tuberculoma**
 - (ab), A. Rüttimann and F. Suter, April, 607
 - (ab), K.-H. Willmann, Jan., 129
- tuberculosis. See Tuberculosis, Pulmonary tumors**
 - bronchial and pulmonary hamartochondromas (ab), Paul. Santy et al, Feb., 286
 - case of "pulmonary adenomatosis" emphasizing diagnostic considerations (ab), Lawrence D. Amick, April, 608
 - occurrence of pulmonary tumors in Strain A mice following total-body x-radiation and injection of nitrogen mustard (ab), W. E. Heston et al, May, 799
 - pseudotumoral pulmonary syphilis (ab), J. Royer and A. Gloaguen, Jan., 128
 - thoracic sympatheticoblastoma simulating an intrapulmonary tumor (ab), Zdeněk V. Skokan, March, 446
- LUSE, SARAH. See MERCER, ROBERT D.**
- LUSHBAUGH, C. C., STOREY, J. B., and HALE, D. B.:** Experimental acute radiodermatitis following beta irradiation. I. Its pathogenesis, and repair. II. The inhibition of fibroplasia. III. The changes in water, fat, and protein content. IV. Changes in respiration and glycolysis. V. Histopathological study of the mode of action of therapy with Aloe vera (ab), June, 919
- LUST, FRANZ J.:** Correlation of roentgenological studies with certain clinical symptoms in peptic ulcer (ab), June, 902
- LUTTRELL, CHARLES. See HARRISON, CLINTON R.**
- LYMPH NODES**
 - giant follicular lymphoblastoma (Brill-Symmers disease) of pelvic lymph nodes clinically resembling an ovarian tumor, with 5-year freedom from symptoms following radiation therapy (ab), J. H. Muller, June, 915
 - localization of radioactivity in regional lymph nodes (ab), Harold F. Berg et al, May, 795
 - tonsillar hypertrophy and mediastinal-hilar adenopathy (ab), Carlo Dazzi, Feb., 287
- cancer**
 - irradiated and obstructed submaxillary salivary glands simulating cervical lymph node metastasis, John C. Evans and Lauren V. Ackerman, April, 550
 - post-irradiative prophylactic extraperitoneal lymphadenectomy in carcinoma of uterine cervix (ab), Gunnar Gorton, Jan., 151
- tuberculosis**
 - x-ray therapy of peripheral lymphadenitis (ab), Joseph N. Aceto et al, June, 915
- LYMPHADENITIS. See Lymph Nodes**
- LYMPHANGIECTASIS. See Lymphatic System**
- LYMPHANGIOSARCOMA. See Sarcoma, angiosarcoma**
- LYMPHATIC SYSTEM**
 - concerning a case of pulmonary lymphangiectasis (ab), K. Reinhardt, March, 447
 - effect of roentgen irradiation on laryngotracheal lymph vessels (ab), Claudio Sbernini and Ivo Orlandini, March, 476
 - lymphatic drainage following intrabronchial instillation of silver-coated radioactive gold colloids in therapeutic quantities (ab), P. F. Hahn and E. L. Carothers, Jan., 155
- LYMPHEDEMA. See Arms**
- LYMPHOBLASTOMA. See Lymph Nodes**
- LYMPHOMA. See Tumors, lymphoma**
- LYON, RICHARDS P. See SMITH, DONALD R.**

M

- McANDREW, M. J. See WATROUS, R. M.**
- MACARINI, NEOPOLLO:** Looser zones (Umbauzonen) of multiple localization and atypical course (ab), May, 782
- MacCALLUM, JAMES D. See CHARDACK, WILLIAM M.**
- McCLEAN, ROBERT W. See SILVERMAN, JACOB J.**
- McCORM, MALCOLM C. See BLOUNT, S. GILBERT, Jr.**
- McCORT, JAMES J., and PARE, PETER J.:** Pulmonary fibrosis and cor pulmonale in sarcoidosis, April, 496

- McCULLAGH, E. PERRY. See PORTMANN, U. V.**
- McCUNE, WILLIAM S., and KESHISHIAN, JOHN M.:** Postoperative intestinal obstruction (ab), March, 454
- McDANIEL, SHAW, and HULL, JOHN G.:** Bagasse disease of the lungs. Brief review of the literature and report of two cases (ab), April, 610
- MACDONALD, COLIN, and THOMAS, SHIRLEY:** One thousand complete pelvimetries: a radiological and obstetrical analysis (ab), Jan., 146
- McGARRITY, K. A.:** Value of serial biopsies following irradiation of carcinoma of the cervix (ab), March, 471
- McGIRR, E. M., and HUTCHISON, JAMES H.:** Radioactive-iodine studies in non-endemic goitrous cretinism (ab), April, 636
- MACGREGOR, ALASTAIR G., MILLER, H., BLANEY, P. J., and WHIMSTER, W. S.:** Diagnosis of thyrotoxicosis by a simple out-patient radioactive iodine technique (ab), May, 793
- MacGREGOR, J. B. See SHIELDS, W. E.**
- MACK, ROBERT E.:** The use of radioactive iodine in the diagnosis and treatment of hyperthyroidism (ab), Feb., 313
- MacKENZIE, IAN, and HAMILTON, H. A. R.:** Arteriography. A simple technique (ab), Jan., 150
- McKISSOCK, WYLLIE. See LAYNE, D. A.**
- MACMILLAN, ALEXANDER S. See SCHALL, LeROY A.**
- McNEER, GORDON. See TABAH, EDWARD J.**
- McNINCH, EUGENE R. See DAVIDSON, CHARLES N.**
- MacPHEE, IAN W.:** Disorders of motility of the small bowel, (ab), Feb., 293
- MCRAE, D. L.:** Bony abnormalities in the region of the foramen magnum: correlation of the anatomic and neurologic findings (ab), June, 892
- and BARNUM, A. S.:** Occipitalization of the atlas (ab), May, 766
- MADDEN, SIDNEY C. See TULLIS JOHN L.**
- MAGGI, ALBERTO L. C., and MEEROFF, M.:** Stenosis of the stomach caused by corrosive gastritis (ab), May, 775
- MAGLIONE, ANTHONY A. See DEUTSCHBERGER, OTTO**
- MAHER, R. F. See BROWN, W. M. COURT**
- MAHER, HERBERT C., and GOULD, WILBUR J.:** Agenesis of the lung with vascular compression of the tracheobronchial tree (ab), April, 607
- MAINLAND, DONALD:** Evaluation of the skeletal age method of estimating children's development. I. Systematic errors in the assessment of roentgenograms (ab), May, 781
- MALNUTRITION. See Cytosiderosis**
- MALOOF, FARAHE. See DOBYNS, BROWN M.**
- MANDIBLE. See Jaws**
- MANTHEI, R. W. See BARCLAY, W. R.**
- MAŇATKA, ZDENEK, and STREDA, ADOLF:** Generalized hyperostosis and pachyderma (ab), March, 457
- MARCK, ABRAHAM, WIRTHWEIN, CARLTON, and MELAMED, ABRAHAM:** Hemangioendothelioma of the vagina (ab), May, 791
- See MELAMED, ABRAHAM**
- MARDER, SUMNER N., SEAMAN, WILLIAM B., and WILSON, HUGH M.:** The pulmonary circulation in the diagnosis of congenital heart disease (ab), Jan., 133
- See SEAMAN, WILLIAM B.**
- MARGOLIN, S. See HAWKINS, G. KENNETH**
- MARIENFELD, CARL J. See GASUL, BENJAMIN M.**
- MARKE, PAUL A., and ROOF, BETTY S.:** Pericardial effusion associated with myxedema (ab), June, 898
- MARSH, JULIAN B., CASTEN, GUS G., and ELLIOTT, HELEN F.:** Uptake of P³² by cardiac muscle in vivo (ab), March, 475
- MARSHAK, RICHARD H., YARNIS, HARRY, and FRIEDMAN, A. I.:** Giant benign gastric ulcers (ab), May, 776
- MARSHALL, DANIEL:** Giant rugae with normal overlying mucosa simulating gastric neoplasm. Report of a case (ab), Feb., 292
- MARSHALL, SAMUEL F.:** Relation of gastric ulcer to carcinoma of the stomach (ab), April, 618
- MARSTON, ROBERT Q., GONSHERY, LEON, ALDERMAN, ILO M., and SMITH, WILLIE W.:** Experimental infection and streptomycin treatment in irradiated mice (ab), Jan., 161
- See GONSHERY, LEON**
- MARTIN, E., and FALLET, G. H.:** Chronic pneumopathies and rheumatism (ab), June, 897
- MARTIN, F. A., WEBSTER, J. E., and GURDJIAN, E. S.:** The relative accuracy of electroencephalography, air studies and angiography in a series of two hundred mass lesions (ab), May, 764
- MARTIN, F. R. R., and CARR, R. J.:** Crohn's disease involving the stomach. A report on two cases (ab), Jan., 136
- MASCHERPA, FERMO, and LOMBARDI, GUIDO:** Laminography in the study of cerebral sulci and cisternal spaces (ab), Jan., 124
- MASOUREDIS, S. P., MELCHER, L. R., and MILLER, PATRICIA:** Behavior of iodide¹³¹ in guinea pigs and of P³² rabbit globulin in guinea pigs and rabbits (ab), Jan., 156
- MASS SURVEYS. See Heart, abnormalities; Heart, diseases; Thorax; Tuberculosis, Pulmonary, mass roentgenologic surveys**
- MAST CELLS. See Skin, tumors**
- MASTOID**
 - primary carcinoma of mastoid process; case (ab), Russell G. Means and John Gersten, Jan., 156
- MASY, S., and GRÉGOIRE, A.:** Cisternography (ab), June, 800

- MATTSSON, OVE:** A simple centering device for radiographic tubes (ab), May, 789
A simple method of ensuring correct concentration of barium contrast media (ab), April, 631
- MATZINGER, K. E.:** Gastric diverticula (ab), March, 452
- MAXILLARY SINUS**
—primary plasma-cell tumors of upper air passages with particular reference to involvement of maxillary sinus (ab), Clyde A. Heatly, April, 631
—some rare diseases (ab), L. Psenner, March, 443
- MAYNEORD, W. V., KEYNES, R. D., MORLEY, T. P., ET AL:** Discussion on the use of isotopes in neurology (ab), Feb., 312
- See **LAYNE, D. A.**
- MAZZOLENI, GIANFRANCO:** A rare radiologic finding; an endophalangeal cyst from an epidermal implant (ab), April, 624
- MEANS, RUSSELL G., and GERSTEN, JOHN:** Primary carcinoma of the mastoid process. Case report (ab), Jan., 156
- MECKEL'S DIVERTICULUM.** See Intestines, diverticula
- MECKSTROTH, CHARLES V., and CURTIS, GEORGE M.:** Criteria for therapy of malignant thyroid lesions with I^{131} (ab), May, 794
- MECONIUM**
—peritonitis (ab), T. L. C. Pratt, May, 779
- MEDIASTINUM**
See also Emphysema; Lymph Nodes
tumors
—mediastinal lipoma simulating cardiac enlargement (ab), A. M. Gottlieb et al, April, 610
—of thymic origin (ab), Frederick M. Binkley et al, Feb., 308
- MEDICINE**
—trends in modern medicine (presidential address) (ed), Ira H. Lockwood, March, 427
- MEDULLOBLASTOMA.** See Cerebellum
- MEEROFF, M.** See **MAGGI, ALBERTO L. C.**
- MEETINGS**
See also American College of Radiology; Inter-American Congress of Radiology; International Congress of Radiology; Radiological Society of North America; etc.
—so you are going to present a scientific paper (ed), Robert P. Barden, June, 875
- MEIGS, JOE V.:** Carcinoma of the cervix—an experience with the surgical treatment (ab), March, 470
- MEIGS SYNDROME.** See Ovary, tumors
- MELAMED, ABRAHAM, HAUKOHL, ROBERT S., and MARCK, ABRAHAM:** Prolapse of gastric mucosa: summary of 150 cases (ab), Feb., 292
- and **MARCK, ABRAHAM:** Esophageal obstruction due to Serutan (ab), March, 451
- See **MARCK, ABRAHAM**
- MELANIN**
—jejunal polyps and intussusception associated with abnormal melanin pigmentation (ab), W. Glenn Young, Jr., April, 620
—melanin spots of lips, oral mucosa and digits associated with intestinal polyposis; case (ab), Lloyd F. Sherman and Robert J. Tenner, Jan., 139
- MELCHER, L. R.** See **MASOUREDIS, S. P.**
- MELENDY, OAKLEY A.** See **JONES, GEORGE H.**
- MELICK, W. F., BOLER, T. D., and BLACK, H.:** Translumbar aortography in infants utilizing 70 per cent Urokon as a contrast medium (ab), Jan., 149
- See **BYRNE, JOHN E.**
- MENDELSON, MORTIMER L., and CACERES, EDUARDO:** Effect of x-ray to the kidney on the renal function of the dog (ab), March, 476
- MENEGHINI, CARLO, and de MARCHI, RENATO:** Pneumoperitoneum in the radiologic diagnosis of cardiac and paracardial tumors of the stomach (ab), Jan., 136
- MENINGES**
—lumbar and sacral cysts of meningeal origin, Kenneth J. Strully and Saul Heiser, April, 544
—myelographic demonstration of cysts of spinal membranes, Lewis G. Jacobs, James K. Smith and Philip S. Van Horn, Feb., 215
—treatment of meningeal system by means of radioactive colloidal gold and x-rays (ab), Charles L. Lewis, June, 914
- hemorrhage**
—aneurysmal origin of non-fatal subarachnoid hemorrhage: angiographic survey of 53 cases (ab), Wallace B. Hamby, Jan., 126
- tuberculosis**
—intracranial calcification as late result of tuberculous meningitis following treatment by streptomycin (ab), R. Garsche, Feb., 282
- tumors**
—meningiomas of anterior clinoid process as cause of unilateral loss of vision: surgical considerations (ab), Alfred Uihlein and Robert D. Weyand, Jan., 124
—pneumographic diagnosis of meningioma of falx (ab), Ture Andersson, June, 888
—spinal meningiomas and neurofibromas (ab), J. W. D. Bull, June, 912
- MENINGIOMA.** See Meninges
- MERCER, ROBERT D., LUSE, SARAH, and GUYTON, DONALD H.:** Clinical diagnosis of generalized cytomegalic inclusion disease (ab), March, 466
- MERSKEY, C.** See **WERBELOFF, L.**
- MERTIN, W.** See **LIESE, E.**
- MESENTERY**
—intestinal obstruction of newborn associated with faulty development of midgut and its mesentery; description of 3 cases (ab), R. Spencer, Jan., 138
- MESOTHELIO, MA.** See Tumors, mesothelioma
- METABOLISM.** See Lipoproteins; Sodium; Thyroxine
- METASTASES.** See Bones; Cancer; Lungs; Lymph Nodes
- METHYLCELLULOSE.** See Bile Ducts
- MEYER, BERTRAND W.** See **JACOBSON, GEORGE**
- MEYER, JOE.** See **GETZOFF, PAUL**
- MICKEY, LORIN J.** See **DOUGHERTY, CARY M.**
- MIDGUT.** See Intestines
- MIFKA, P.:** Angiography following cerebral vascular accidents (ab), April, 606
- MILITARY MEDICINE**
—fracture of carpal navicular (scaphoid) bone: end-result study in military personnel (ab), Joseph S. Barr et al, May, 784
- MILK**
—reversible metastatic calcification associated with excessive milk and alkali intake (ab), Paul Wermer et al, Jan., 141
- MILKMAN'S SYNDROME.** See Bones, diseases
- MILLER, ALDEN H., and FISHER, H. RUSSELL:** Carcinoma-in-situ of the larynx (ab), April, 632
- MILLER, CLARK F., and CARRIER, JOHN W.:** Use of Telepaque in cholecystography. A comparative study (ab), Feb., 295
- MILLER, EARL R.** See **HINMAN, FRANK, Jr.**
- MILLER, G.:** Bone changes in neurofibromatosis (Recklinghausen) (ab), April, 625
- MILLER, GERALD M.** See **HINMAN, FRANK, Jr.**
- MILLER, H.** See **MACGREGOR, ALASTAIR G.**
- MILLER, PATRICIA.** See **MASOUREDIS, S. P.**
- MILLER, ROBERT W.** See **FURTH, FRANK W.**
- MINTEER, DONALD W.** See **WILSON, RICHARD G.**
- MINUTO, NICOLO.** See **SANQUIRICO, GIOVANNI**
- MITOSIS.** See Cells
- MITRAL VALVE**
—mitral stenosis: diagnosis and treatment (ab), Andrew Logan and Richard Turner, March, 449
—tomographic study of pulmonary veins in mitral disease (ab), J. Moniz de Bettencourt et al, April, 615
- MOCKEL, G., and GAEDE, K.:** Measurement of contrast medium reflux in retrograde pyelography by means of blood Pyridiodine determination (ab), May, 786
- MOIR, J. CHASSAR:** Placentography. Symposium. I. A review of placentography (ab), June, 908
- MONDELLO, MARIO, and BARONE, ARMANDO:** Pneumostriographic study of the stomach (ab), April, 616
- MONILIASIS**
—of lungs; case (ab), J. Smulewicz, May, 770
- MONIZ de BETTENCOURT, J., SALDANHA, ALEU, and BARRETO FRAGOSO, J. C.:** Tomographic study of the pulmonary veins in mitral disease (ab), April, 615
- MONTGOMERY, CHARLES E.** See **ALLEN, MAX S.**
- MOORE, E. B.** See **COLE, A.**
- See **GRIMMETT, LEONARD G.**
- MOORE, JOHN T.** See **DOUGHERTY, CARY M.**
- MOORE, R. L.** See **TOTTEN, R. S.**
- MOORE, SHERWOOD:** The Troell-Junet syndrome (ab), April, 606
- MOOREHEAD, MATTHEW T.:** A new approach to the ulcer problem: irradiation of the surgically exposed stomach. An experimental study, June, 871
- MORALES, OLALLO, and ROMANUS, RAGNAR:** Urethrography in the male. Delimitation of the anterior and posterior urethra, the pars diaphragmatica, the pars nuda urethrae and the presence of a musculus compressor nuda (ab), April, 627
- Urethrography in the male with a highly viscous, water-soluble contrast medium, Umbradil-viscous U (ab), Feb., 303
- MORENNE, P.** See **LOISELEUR, J.**
- MORGAN, J. E.** See **WHEATCROFT, M. G.**
- MORLEY, T. P.** See **MAYNEORD, W. V.**
- MOROS G., GUSTAVO, NERI, RAFAEL J., and VILLAGORDA, GUILLERMO:** Fluorodensography with radiopaque substance. A new method for hemodynamic investigation (ab), March, 448
- MORPHINE**
—clinical significance of pharmacoradiography, particularly of morphine, in diseases of stomach and duodenum (ab), H. U. Stössel, June, 901
- MORRISON, A. B.:** The os paracuneiforme. Some observations on an example removed at operation (ab), March, 462
- MORTENSEN, JD, BAGGENSTOSS, ARCHIE H., POWER, MARSCHELLE H., and PUGH, DAVID G.:** Roentgenographic demonstration of histologically identifiable renal calcification, May, 703
- MORTON, JOSEPH L., BARNES, ALLAN C., HENDRICKS, CHARLES H., and CALLENDINE, GEORGE W., Jr.:** Irradiation of cancer of the uterine cervix with radioactive cobalt 60 in guided aluminum needles and in plastic threads (ab), March, 473
- MORTON, M. E.:** Measurement of thyroxine synthesis with I^{131} . A test for evaluation of thyroid function in equivocal states (ab), Feb., 314
- MORTON, PAUL C.:** Adenomas of the colon and rectum. Diagnosis and treatment in relation to cancer prevention (ab), May, 778

- MOTHER-OF-PEARL WORKERS.** See Industry and Occupations
- MOUNT, LESTER A.** See **RAMOS, MIGUEL**
- MOUTH**
—melanin spots of lips, oral mucosa and digits associated with intestinal polyposis; case (ab), Lloyd F. Sherman and Robert J. Tenner, Jan., 139
- cancer**
—carcinoma of oral cavity and lower jaw (ab), S. P. Srivastava, May, 791
—treatment of oral cavity cancers; present status of radiotherapy (ab), Gilbert H. Fletcher, Feb., 311
- MUCOCLE.** See Lungs
- MÜLLER, H.**: Cyst formation in graphite pneumoconiosis (ab), June, 897
- MÜLLER, J. H.**: Case of giant follicular lymphoblastoma (Brill-Symmers disease) of the pelvic lymph nodes clinically resembling an ovarian tumor, with five-year freedom from symptoms following radiation therapy (ab), June, 915
- MULHOLLAND, JOHN H.** See **DOUBILET, HENRY**
- MURI, JAN.**: Arterio-venous aneurysm of the lung (ab), May, 771
- MURPHY, DOREEN.**: A case of lung cyst in infancy (ab), March, 447
- MURTAGH, FREDERICK.** See **LIN, PAUL**
- MUSCLES**
See also Heart: Myositis
—effect of Prisciline on clearance of radiosodium from muscle and skin of man in normal and diseased limbs (ab), Jack Freund et al., May, 796
- MUSCULOTENDINOUS CUFF.** See Shoulder
- MUSNICK, HENRY.** See **BARR, JOSEPH S.**
- MUSSELMAN, MERLE M.** See **GABRIEL, LOUIS T.**
- MYCOSIS**
See also Coccidioidomycosis; Histoplasmosis; Toxoplasmosis; etc.
—fungal infection of bone, Robert J. Reeves and Robert Pedersen, Jan., 55
- MYELOGRAPHY.** See Meninges; Spinal Canal Roentgenography; Spinal Cord
- MYERS, ABRAHAM.**: Degeneration of cervical intervertebral disks following whip-lash injury (ab), Feb., 297
- MYERS, WILLIAM G.** See **HENSCHKE, ULRICH K.**
- MYHRE, EIVIND.** See **SHEEL, AXEL**
- MYOCARDIUM.** See Heart
- MYOMA.** See Tumors, myoma
- MYOSITIS**
—myositis ossificans progressiva, Edward B. Singleton and John F. Holt, Jan., 47
—prolonged pulmonary forms of Bornholm's disease (ab), A. Breton, Jan., 128
- MYXEDEMA.** See Thyroid, hypothyroidism
- N**
- NABARRO, J. D. N.**: Cardiac involvement in malignant lymphoma (ab), May, 792
- NADAS, ALEXANDER S., ROSENBAUM, HAROLD D., WITTENBERG, MARTIN H., and RUDOLPH, ABRAHAM M.**: Tetralogy of Fallot with unilateral pulmonary atresia. A clinically diagnosable and surgically significant variant (ab), April, 614
- See **ROSENBAUM, HAROLD D.**
- NAGASAKI.** See Atomic Bomb
- NAGLE, ROBERT B., and PEIRSON, EDWARD L.**: A study of the radiation hazard in urology (ab), June, 911
- NAJMAN, E.** See **GVOZDANOVIĆ, V.**
- NANSON, E. M., and WALKER, R. MILNES.**: Partial spontaneous rupture of the oesophagus (ab), March, 451
- NARDIELLO, VINCENT.** See **SCHWARTZ, JEROME**
- NASIO, JUAN.**: Action of Banthine on motility of the small intestine studied by rapid method (ab), April, 620
- NATHANSON, LOUIS.** See **LEWITAN, ALEXANDER**
- NATIONAL BUREAU OF STANDARDS**
—Handbook 56, Safe Handling of Cadavers Containing Isotopes, March, 439
- NAVICULAR BONE.** See Scaphoid Bone, Tarsal
- NEAL, WILLIAM.** See **BLOCK, MATTHEW**
- NEALE, RODERICK M.** See **BRIGGS, JOHN D.**
- NECK**
—absorption of x-rays by tissues of head and neck, M. G. Wheatcroft and J. E. Morgan, March, 423
- NECROSIS**
See also Brain: Radiations, injurious effects
—aseptic necrosis of capitulum humeri (ab), C. Buetti, June, 907
- NEERKEN, ADRIAN J.** See **PECK, MORDANT E.**
- NEGROES**
—infantile cortical hyperostosis (Caffey-Smyth syndrome); case in Negro infant (ab), Melvin E. Jenkins and Roland B. Scott, March, 458
- NEILL, C. A.** See **KEITH, JOHN D.**
- NELIGAN, G. A.** See **BREMNER, A. E.**
- NELLEN, MAURICE.** See **GOETZ, R. H.**
- NEPHROCALCINOSIS.** See Kidneys
- NERI, RAFAEL J.** See **MOROS G., GUSTAVO**
- NERVES**
acoustic
—vertebral angiography in diagnosis of acoustic nerve tumors (ab), Olle Olsson, Feb., 281
- trigeminal
—some developments in technic of trigeminal injection (ab), John Penman, Feb., 283
- NERVOUS SYSTEM, SYMPATHETIC**
—malignant sympathetic neuroectodermal tumor (ab), Solomon R. Bersack and Hugo V. Rizzoli, Feb., 300
- NESBIT, REED M., and NESBITT, THOMAS E.**: Experiences with high concentration Urokon for pyelography (ab), June, 908
- NESBITT, THOMAS E.** See **NESBIT, REED M.**
- NEUHAUSER, EDWARD B. D., and WITTENBERG, MARTIN H.**: Pediatric radiology (ab), May, 791
- See **ROSENBAUM, HAROLD D.**
- NEURALGIA.** See Nerves, trigeminal
- NEURILEMMOMA.** See Tumors, neurofibroma
- NEUROECTODERMAL TUMOR.** See Nervous System, Sympathetic
- NEUROFIBROMA.** See Tumors, neurofibroma
- NEUROFIBROMATOSIS**
—bone changes in neurofibromatosis (Recklinghausen) (ab), G. Miller, April, 625
- NEUROLOGY**
—discussion on use of isotopes in neurology (ab), W. V. Mayneord et al., Feb., 312
- NEURORADIOLOGY.** See Cranium, roentgenography
- NEVIASER, JULIUS S.**: Common injuries of the musculotendinous cuff of the shoulder (ab), Feb., 299
- NEWELL, W. G.** See **STEEN, LOWELL H.**
- NEWTON, ROBERT A.** See **BOTSFORD, THOMAS W.**
- NICE, CHARLES M., and STENSTROM, K. WILHELM.**: Irradiation therapy in Hodgkin's disease, May, 641
- NICHOLS, GREGORY B.**: An inexpensive semi-automatic serialographic apparatus for angiography (ab), March, 444
- NICKEL, ELDON.** See **HINMAN, FRANK, Jr.**
- NICKSON, JAMES J.** See **LAWRENCE, WALTER, Jr.**
- NICOLOV, N.**: Radiation therapy of cancers of the cervix from 1931-1946 (ab), May, 792
- NISSEN, R.**: Difficulties in the early diagnosis of carcinoma of the esophagus (ab), June, 900
- See **LISA, JAMES R., and ELKAN, WOLF.**: Osteochondroma of the bronchus (ab), March, 448
- NITROGEN**
—nitrogen balance in malignant disease (ab), Norman Bolker, March, 467
- NITROGEN MUSTARD**
—occurrence of pulmonary tumors in Strain A mice following total-body x-radiation and injection of nitrogen mustard (ab), W. E. Heston et al., May, 799
- NOLAN, JAMES F., and DuSAULT, LUCILLE.**: Optimum dosage studies for radiation therapy of carcinoma of the uterine cervix, June, 862
- NOLAN, JOHN J., and LEE, J. GORDON.**: Duplications of the alimentary tract in adults, with a report of three cases (ab), Jan., 134
- NORMAN, OLOF.**: Placentography. Symposium. III. Localisation of the placenta by means of arteriography and auscultation (ab), June, 908
- NOSE**
—malignant tumors of nasal fossa and ethmoid: radiologic study. Attempt at topographic classification (ab), P. Eggimann, Jan., 126
- NUCLEAR EXPLOSION.** See Atomic Bomb
- NUCLEINS**
—influence of homologous tissue factors on DNA turnover and radiation protection (ab), Lola S. Kelly and Hardin B. Jones, Jan., 162
- NURICK, A. W., PATEY, DAVID H., and WHITESIDE, C. G.**: Percutaneous transhepatic cholangiography in the diagnosis of obstructive jaundice (ab), May, 780
- O**
- OAK RIDGE INSTITUTE OF NUCLEAR STUDIES.** See Teaching
- OBERHOFER, B.** See **GVOZDANOVIĆ, V.**
- OBITUARIES**
West, James Hubert, March, 434
- OBRYCKI, R. F., BALL, R. M., and DAVIDON, W. C.**: Economical shielding for multicurie sources (ab), June, 919
- OBSTETRICS.** See Amniotic Fluid; Labor; Pelvis, measurement; Placenta; Pregnancy
- OCCIPITAL BONE**
—occipitalization of atlas (ab), D. L. McRae and A. S. Barnum, May, 766
- OCHSNER, A., and BLALOCK, J.**: Carcinoma of the stomach. Necessity for re-evaluation of therapeutic philosophy (ab), Feb., 291
- ODABACHIAN, M.** See **ROCHE, G.**
- ODÉN, SVEN.**: Diagnosis of spinal tumours by means of gas myelography (ab), June, 911
- O'DONAGHUE, JAMES.**: Selection of the far advanced cancer patient for roentgen therapy (ab), April, 635
- OGURA, GEORGE I.** See **SALZMAN, EMANUEL**
- OLD AGE**
—dissolution of intervertebral disk in aged normal: the phantom nucleus pulposus, J. Gershon-Cohen, Harald Schraer, David M. Sklaroff and Nathan Blumberg, March, 383
—non-malignant roentgen changes in the gastrointestinal tract associated with aging (ab), Everett L. Pirkey et al., March, 451

- OLDHAM, J. S.** See **ASTLEY, ROY**
OLIVIER, I. CAUDE. See **ALBOT, GUY**
OLNICK, HERBERT M., and WATKINS, WILLIAM M.: Barium peritonitis (ab), March, 455
O'LOUGHLIN, BERNARD J. See **SOUCHERAY, PHILIP H.**
OLSEN, ARTHUR M., HOLMAN, COLIN B., and ANDERSEN, HOWARD A.: Diagnosis of cardiospasm (ab), March, 451
OLSSON, OLLE: Vertebral angiography (ab), June, 888
 Vertebral angiography in cerebellar haemangioma (ab), May, 765
 Vertebral angiography in the diagnosis of acoustic nerve tumors (ab), Feb., 281
O'RAHILLY, ROMAN: A survey of carpal and tarsal anomalies (ab), May, 784
ORAM, SAMUEL. See **GARDNER, FRANCES**
ORBIT
 —orbital phlebography; preliminary results (ab), P. Bétoulières, et al, Jan., 127
ORLANDINI, IVO. See **SBERNINI, CLAUDIO**
ORLOFF, T. L., SKLAROFF, D. M., COHN, E. M., and GERSHON-COHEN, J.: Intravenous cholelithography with a new contrast medium, "Cholografin," June, 868
ORTHORENTGENOGRAPHY. See Roentgen Rays, technic
ORTON, HENRY B.: Chordoma—final report and re-evaluation of treatment (ab), April, 606
OS PARACUNEIFORME. See Foot
OSMOND, JOHN D., Jr.: Lesions producing bursitis-like symptoms. Importance of radiographic study before treatment of bursitis (ab), Feb., 299
OSSIFICATION. See Trachea
OSTEITIS
 —See also Pubic Bone; Spine
 —of sphenoid sinus (ab), Lewis L. Haas, Feb., 283
OSTEOARTHRITIS. See Hip
OSTEOARTHROPATHY
 —chronic idiopathic osteoarthritis, Theodore E. Keats and William S. Bagnall, June, 841
 —intrathoracic fibroma associated with pulmonary hypertrophic osteoarthropathy: unusual case (ab), Otto Deutschberger et al, March, 446
OSTEOCHONDRIITIS DEFORMANS
 —osteochondritis deformans coxae juvenilis: familial demonstration (ab), W. R. Hamsa and L. S. Campbell, May, 782
 —osteopetrosis as an early symptom of osteochondritis deformans coxae juvenilis (Perthes) (ab), F. Wirz, Feb., 299
OSTEOCHONDROMA. See Tumors, osteochondroma
OSTEOCLASTOMA. See Tumors, osteoclastoma
OSTEOGENESIS IMPERFECTA
 —peculiar structural changes in epiphyseal and metaphyseal regions in osteogenesis imperfecta tarda (ab), G. Liess, June, 906
OSTEOMALACIA. See Bones, diseases
OSTEOMATOSIS. See Leontiasis Ossium
OSTEOMYELITIS
 —See also Spine
 —septic arthritis and osteomyelitis in infancy (ab), Seymour Heymann et al, March, 458
OSTEONEPHROPATHY. See Dwarfism, renal
OSTEOPATHIA STRIATA. See Osteosclerosis fragilis
OSTEOPATHY. See Dwarfism, renal
OSTEOPETROSIS. See Osteosclerosis fragilis
OSTEOPOROSIS. See Bones, atrophy
OSTEOSCLEROSIS FRAGILIS
 —osteopathia striata—Voorhoeve's disease: case presenting features of osteopathia striata and osteopetrosis (ab), R. L. Hurt, Jan., 140
OTT, V. R.: Spondylitis hyperostotica (ab), June, 905
OVARY
 —developmental defects following irradiation of ovaries in child (ab), U. V. Portmann and E. Perry McCullagh, Jan., 158
 —effects of fractionated doses of x-radiation on normal and tumor tissue (ab), L. C. Fogg and R. F. Cowing, Feb., 318
CANCER
 —recurrences after treatment of malignant tumors of female genitalia (ab), H. Czech and R. K. Kepp, Jan., 153
 —serous cystadenocarcinoma: review of 127 cases (ab), Carl T. Javert and Robert R. Rascoe, Feb., 309
TUMORS
 —giant follicular lymphoblastoma (Brill-Symmers disease) of pelvic lymph nodes clinically resembling an ovarian tumor, with 5-year freedom from symptoms following radiation therapy (ab), J. H. Muller, June, 915
 —Meigs' syndrome; case in child (ab), William E. Knaus et al, April, 625
OVERHOF, K.: Observations on radiotherapy of bony metastases of breast carcinoma (ab), Jan., 151
OWENS, JANET P. See **PEARSON, W. N.**
OXYGEN
 —See also Pneumography
 —action of reducing substances on the latent radiation effect in vitro (ab), J. Loiseleur et al, May, 799
 —chemical synthesis following action of roentgen rays (ab), A. Lacassagne and J. Loiseleur, May, 799
 —chemical synthesis following action of physical peroxidase agents (roentgen rays, ultraviolet and ultrasonic rays) (ab), A. Lacassagne and J. Loiseleur, May, 799
 —secondary evolution of molecules having a phenol radical, following roentgen irradiation (ab), J. Loiseleur and M. Sauvage, May, 799
PACHYDERMA. See Skin
PAGET'S DISEASE. See Breast
PAILLAS, J. See **DELARUE, J.**
PALATE
 —radiation therapy of carcinoma (ab), Felice Perussia, June, 914
PALEIRAC, R. See **BÉTOULIÈRES, P.**
PANCOAST SYNDROME. See Bronchi, cancer
PANCREAS
 aberrant
 —Meckel's diverticulum with intussusception, ulceration with hemorrhage, and ectopic gastric mucosa and pancreatic tissue (ab), Michael F. Koszalka, April, 621
CANCER
 —diagnosis of biliary-pancreatic cancer (ab), Henry Doubilet et al, Feb., 295
 —pancreatic, ductal, and vaterian neoplasms: their roentgen manifestations, Philip J. Hodes, Eugene P. Pendergrass and Norman J. Winston, Jan., 1
CYSTS
 —true cyst in early infancy; case (ab), Alberto Calderin Gomez, Feb., 296
DISEASES
 —bronchial obstruction with lobar atelectasis and emphysema in cystic fibrosis of pancreas (ab), Paul A. di Sant'Agnes, May, 771
 —roentgen demonstration of cirrhosis of liver with fatty metamorphosis; case due to congenital fibrocystic disease, Howard L. Steinbach, Jackson T. Crane and Henry B. Bruyn, June, 858
INFLAMMATION
 —radiation therapy of pancreatitis, C. H. Heacock and D. J. Cara, Jr., May, 654
 —roentgen manifestations of relapsing pancreatitis, Maxwell H. Poppel, April, 514
PANCREATIC DUCTS
 —bile and contrast medium reflux into pancreatic ducts (ab), Friedrich K. Kämmerling, April, 622
PANCREATITIS. See Pancreas, inflammation
PANTOCAINE
 —could a damaged liver be cause of lethal Pantocain intoxication (during bronchography)? (ab), H. Fietz, Jan., 132
PAPILLOMA. See Tumors, papilloma
PARABIOSIS
 —protection of irradiated rats by parabiosis with adrenalectomized or splenectomized partners, Martin Schneider, Robert C. Wybourne, Robert Binhammer and John C. Finerty, Feb., 234
PARAGONIMIASIS
 —pulmonary paragonimiasis: review with case reports from Korea and Philippines (ab), Francisco T. Roque et al, April, 609
PARATHYROID
 —parathyroid tumor with hyperparathyroidism and coexistent gastric and duodenal ulceration (ab), A. Elkeles, Feb., 287
 —skeletal changes in parathyroid tetany (ab), W. Achenbach and A. Böhm, May, 783
PARE, PETER J. See **MCCORT, JAMES J.**
PARK, FELIX R., CRONK, ROBERT T., and CRONK, GERALD E.: Prevention of iodism in bronchography by use of ACTH. Case report (ab), June, 894
PARKER, LEON O., and deLORIMER, ALFRED A.: Double contrast visualization of joints (ab), March, 455
PARKINSON, CHARLES E.: The supracondylar process, April, 556
PARKINSON, DWIGHT. See **CHILDE, ARTHUR E.**
PARKS, JOHN. See **BARTER, ROBERT H.**
PARROTT, MAX H. See **ADAMS, THEODORE W.**
PARSONS, CLIFFORD. See **ASTLEY, ROY**
PARSONS, HERBERT. See **KNOX, W. GRAHAM**
PARSONS, PHILIP B.: Paraduodenal hernias (ab), Feb., 294
PARSONS, ROBERT J. See **BERLIN, NATHANIEL I.**
PATERSON, EDITH, and FARR, R. F.: Cerebellar medulloblastoma: treatment by irradiation of the whole central nervous system (ab), Feb., 307
PATEY, DAVID H. See **NURICK, A. W.**
PATTINSON, J. N.: Anomalous right subclavian artery (ab), Feb., 290
PATTON, RICHARD. See **LOVINGOOD, CHARLES G.**
PEABODY, J. WINTHROP, Jr., ZISKIND, JOSEPH, BUECHNER, HOWARD A., and ANDERSON, AUGUSTUS E.: Intrathoracic hibernoma (ab), June, 897
PEAKE, JOHN D. See **ESKRIDGE, MARSHALL**
PEARCE, JOHN. See **UMIKER, WILLIAM**
PEARSON, W. N., OWENS, JANET P., HUDSON, GRANVILLE W., and DARBY, WILLIAM J.: Effect of whole-body x-irradiation on urinary B-vitamin excretion of rats (ab), Feb., 319
PECK, H. See **BARRETT, T. F.**
PECK, MORRANT E., NEERKEN, ADRIAN J., and SALZMAN, EMANUEL: Clinical experience with the water-soluble bronchography compounds (ab), Jan., 131
PEDERSEN, ROBERT. See **REEVES, ROBERT J.**
PEDIATRICS
 —See also Children; Infants, Newborn
 —pediatric radiology (ab), Edward B. D. Neuhauser and Martin H. Wittenborg, May, 791

- PEIRCE, E. CONVERSE, II:** Temporary hemiplegia from cerebral injection of Diodrast during catheter aortography. Report of two cases (ab), Jan., 126
- See **DAVIES, JOHN J.**
- and **RAMEY, WILLIAM P.:** Renal arteriography. Report of a percutaneous method using the femoral approach and a disposable catheter (ab), Feb., 306
- PEIRSON, EDWARD L.** See **NAGLE, ROBERT B.**
- PELTIER, LEONARD F.:** Impact of Röntgen's discovery upon the treatment of fractures (ab), Feb., 296
- PELVIS**
- production of ACTH in patient undergoing gynecologic surgery or receiving pelvic irradiation (ab), Allan C. Barnes, Feb., 318
 - lymph nodes. See Lymph Nodes
 - measurement
 - assessment of value of Chassar Moir graphs in radiological investigation of cephalopelvic disproportion (ab), John P. Erskine et al, April, 627
 - one thousand complete pelvimetries: radiological and obstetrical analysis (ab), Colin Macdonald and Shirley Thomas, Jan., 146
 - outlet pelvimetry and symphysis-biparietal and sacral-biparietal diameters (ab), Laurence G. Roth, April, 627
 - pelvic study. II. Complete pelvimetry, including use of a proposed new system of pelvic profile description (ab), Laurence G. Roth, April, 626
 - simple method of roentgen pelvimetry (ab), Robert W. Curry, Feb., 302
 - roentgenography
 - advantages of x-ray diagnosis in pregnancy (ab), Robert H. Barter and John Parks, May, 785
 - pelvic study. I. The sacrum, its significance in obstetrics (ab), Laurence G. Roth, April, 626
 - value of lateral pelvic roentgenogram as index of fetal maturity and type of maternal pelvis (ab), J. Bay Jacobs, Feb., 302
- PENDERGRASS, EUGENE P.,** president of the Radiological Society of North America (ed), Robert P. Barden, Feb., 263
- PENDERGRASS, EUGENE P., and BROOKS, FRANK P.:** Report of a case of osteonephropathy with vascular calcification in infancy, Feb., 227
- See **GREENING, ROY R.**
- See **HODES, PHILIP J.**
- See **PRYDE, ARTHUR W.**
- PENMAN, JOHN:** Some developments in the technique of trigeminal injection (ab), Feb., 283
- PENNYBACKER, J. B.** See **SHELDON, P. W. E.**
- PEPTIC ULCER**
- See also Esophagus
 - chronic gastric ulcer in childhood: critical analysis of literature, with report of case in 11-year-old boy (ab), Walter M. Block, March, 453
 - coexistence of peptic ulcer and idiopathic ulcerative colitis (ab), Bernard H. Chaiken et al, March, 454
 - correlation of roentgenological studies with certain clinical symptoms (ab), Franz J. Lust, June, 902
 - experimental gastrojejunal ulcers produced by reversing duodenum (ab), John M. Hammer et al, April, 619
 - gastric block: a disturbance in gastric motive function (ab), Bengt Lilja, March, 452
 - giant benign gastric ulcers (ab), Richard H. Marshak et al, May, 776
 - in childhood (ab), Bertram R. Girdany, April, 619
 - parathyroid tumor with hyperparathyroidism and coexistent gastric and duodenal ulceration (ab), A. Elkeles, Feb., 287
 - pyloric channel ulcer (ab), E. Clinton Texter, Jr., et al, May, 776
 - ulcer of greater gastric curvature (ab), Arthur D. Silk et al, March, 453
- cancer and peptic ulcer**
- gastric ulcer and gastric cancer (ab), I. S. Ravdin and Robert C. Horn, Jr., April, 618
 - relation of gastric ulcer to carcinoma of stomach (ab), Samuel F. Marshall, April, 618
- perforation.** See also Peptic Ulcer, therapy
- pneumoperitoneum in perforated peptic ulcer: factors in roentgenographic demonstration (ab), Walter Gaines, April, 619
 - spontaneous perforation of benign gastric ulcer into transverse colon: case (ab), William R. Bosien and M. Dawson Tyson, March, 454
- surgical therapy**
- carcinoma of stomach following gastroenterostomy for duodenal ulcer (ab), Lloyd A. Stirrett and John M. Beal, April, 618
 - post-gastrectomy stomach remnant (ab), C. N. Pulvertaft, May, 777
 - radiological guidance in surgical treatment of gastroduodenal ulcer (ab), Giancarlo Lisch, May, 776
 - x-ray irradiation and conservative surgery in treatment of chronic duodenal ulcer (ab), R. Kaye Scott et al, May, 776
- therapy.** See also Peptic Ulcer, surgical therapy
- gastric ulcer with massive hemorrhage following use of Phenylbutazone; case (ab), Philip Krainin, March, 454
 - multiple gastric ulcers occurring during Phenylbutazone therapy (ab), Edward C. Raffensperger, March, 454
 - new approach to ulcer problem: irradiation of surgically exposed stomach; experimental study, Matthew T. Moorehead, June, 871
 - perforation following administration of Phenylbutazone (ab), W. E. Shields et al, March, 454
 - reversible metastatic calcification associated with excessive milk and alkali intake (ab), Paul Werner et al, Jan., 141
 - value of radiology in assessing progress of duodenal ulceration under treatment (ab), George Simon and George du Boulay, June, 902
- PERABODIL BR.** See Bronchi, roentgenography
- PEREIRA, ATHAYDE:** Roentgen interpretation of vesiculograms (ab), March, 464
- PERICARDITIS.** See Pericardium
- PERICARDIUM**
- cysts about pericardium (ab), Carl Davis, Jr., et al., April, 612
 - pericardial effusion associated with myxedema (ab), Paul A. Marks and Betty S. Roof, June, 898
 - radiological diagnosis of rheumatic pericardial effusion (ab), E. M. M. Besterman and G. T. Thomas, Feb., 289
- PERIOSTEOPATHY.** See Periosteum
- PERIOSTEUM**
- periosteopathy of mother-of-pearl workers (ab), Antonio Runco and Roberto Bossi, May, 781
- PERITONEUM.** See Abdomen; Peritonitis
- PERITONITIS**
- barium peritonitis (ab), Herbert M. Olnick and William M. Watkins, March, 455
 - meconium peritonitis (ab), T. L. C. Pratt, May, 779
- PERRY, WILLIAM F.** See **ZINGG, WALTER**
- PERSKY, LESTER.** See **JOELSON, JAMES J.**
- PERTHES' DISEASE.** See Osteochondritis
- PERUSSIA, FELICE:** Radiation therapy of carcinoma of the palate (ab), June, 914
- PETERS, M. VERA:** Carcinoma of the breast, with particular reference to pre-operative radiation (ab), April, 633
- See **ASH, C. L.**
- PETRUCI, D.** See **TORI, G.**
- PFANDER, FRIEDRICH.** See **KANITZ, HELMUT R.**
- PHALANGES.** See Fingers and Toes
- PHANTOM NUCLEUS PULPOSUS.** See Spine, intervertebral disks
- PHARMACORADIOGRAPHY.** See Morphine
- PHARYNX**
- roentgenologic diagnosis and follow-up of hypopharyngeal cancer (ab), Solve Welin, March, 468
- PHENOL COMPOUNDS**
- action of reducing substances on latent radiation effect in vitro (ab), J. Loiseleur et al, May, 799
 - secondary evolution of molecules having a phenol radical, following roentgen irradiation (ab), J. Loiseleur and M. Sauvage, May, 799
- PHENYLBUTAZONE.** See Peptic Ulcer, therapy
- PHILATELY**
- x-rays in philately, Herbert C. Pollack and Charles F. Bridgman, Feb., 259
- PHILIPPINE ISLANDS**
- pulmonary paragonimiasis: review with case reports from Korea and Philippines (ab), Francisco T. Roque et al, April, 609
 - report on radiographic measurements of normal sella turcica in Filipinos (ab), P. J. Garcia and A. M. Laxamana, June, 895
- PHILLIPS, ROBERT I.** See **ELKIN, MILTON**
- PHLEBOGRAPHY.** See Brain, tumors; Extremities, blood supply; Orbit
- PHOSPHATASE**
- effect of 2,000 r local x-irradiation on metabolism and alkaline phosphatase activity of rat bone (ab), S. H. Cohn and J. K. Gong, Feb., 319
- PHOSPHORUS, RADIOACTIVE.** See Radioactivity
- PHOTOFUOROGRAPHY.** See Thorax, roentgenography; Tuberculosis, Pulmonary, mass roentgenologic surveys
- PHOTOGRAPHY**
- Biological Photographic Association, June, 878
 - film measurement of beta-ray depth dose (ab), E. Tochilin and R. Golden, June, 918
 - photographic method of determining distribution of radioactive material in vivo (ab), Sven A. E. Johansson and Bengt Skanse, Feb., 313
- PHTHISIS.** See Tuberculosis, Pulmonary
- PHYSICS AND PHYSICISTS**
- See also Roentgen Rays, physics
 - education and training of health physicists, Elda E. Anderson, Jan., 83
- PIA, H.-W.:** The healing aspects of skull fractures in children (ab), Feb., 282
- PIERCE, FRANK T.** See **HEWITT, JOHN E.**
- PIGMENTATION.** See Melanin
- PILLA, LAWRENCE A.** See **PIRKEY, EVERETT L.**
- PINEAL GLAND**
- roentgenologic recognition of habenular calcification as distinct from calcification in pineal body: its application in cerebral localization (ab), Herbert M. Stauffer et al, May, 765
- PIPKIN, DORIS E.** See **PIRKEY, EVERETT L.**
- PIRKEY, EVERETT L., PILLA, LAWRENCE A., and PIPKIN, DORIS E.:** Non-malignant roentgen changes in the gastro-intestinal tract associated with aging (ab), March, 451
- PITUITARY BODY**
- directed beam therapy. II. Multiple small field irradiation of pituitary gland, pituitary tumors and other intracranial lesions (ab), B. V. A. Low-Beer et al, April, 631

PITUITARY BODY—cont.

- progressive exophthalmos following thyroidectomy cured by irradiation of cerebral centers; case, A. Tevlik Berkman, March, 406

tumors

- diagnosis (ab), John Raaf and Winchell McK. Craig, Jan., 125
- directed beam therapy. II. Multiple small field irradiation of pituitary gland, pituitary tumors and other intracranial lesions (ab), B. V. A. Low-Beer et al, April, 631
- pneumoencephalography in chromophobe adenomas of hypophysis (ab), Louis Bakay and James C. White, March, 443

PLACENTA

- determination of placental site by soft-tissue radiography (ab), A. S. Whitehead, Feb., 301
- effect of pre-eclamptic toxemia on exchange of sodium in body and transfer of sodium across placenta measured by Na^{24} tracer methods (ab), L. Woodrow Cox and T. A. Chalmers, Feb., 316
- exchange of sodium between plasma and extracellular compartments in pregnant women as determined by Na^{24} tracer method (ab), L. Woodrow Cox and T. A. Chalmers, Feb., 316
- placentography. I. A review of placentography (ab), J. Chassar Moir, June, 908
- placentography. II. Direct placentography (ab), Maria E. Grossmann, June, 908
- placentography. III. Localization of placenta by means of arteriography and auscultation (ab), Olof Norman, June, 908
- placentography. V. Radiological localization of placenta (ab), F. Reid, June, 908
- radiological determination of placental site (ab), S. J. Boland, May, 786
- transfer of sodium across the human placenta determined by Na^{24} tracer methods (ab), L. Woodrow Cox and T. A. Chalmers, Feb., 316
- transfer of sodium to amniotic fluid in normal and abnormal cases, determined by Na^{24} tracer methods (ab), L. Woodrow Cox and T. A. Chalmers, Feb., 316
- transfer of sodium to placental blood during third stage of labor determined by Na^{24} tracer methods (ab), L. Woodrow Cox and T. A. Chalmers, Feb., 316

prævia

- placentography. IV. Diagnosis of placenta prævia by soft tissue radiography (ab), A. S. Whitehead, June, 908
- radiographic diagnosis (ab), P. E. Hiebert and Doris A. Kubin, Jan., 146

PLASMA CELL TUMORS. See Tumors, plasmacytoma**PLASMOCYTOMA.** See Tumors, plasmacytoma**PLENE, HENRY P. and GARDNER, ELDON J.:** Osteomatosis (leontiasis ossea): hereditary disease of membranous bone formation associated in one family with polyposis of the colon, June, 830**PLEURA****effusion.** See also Pleurisy

- intracavitary colloidal radiogold in treatment of effusions caused by malignant neoplasms (ab), Gould A. Andrews et al, Jan., 153
- metabolism and distribution of colloidal Au^{198} injected into serous cavities for treatment of effusions associated with malignant neoplasms (ab), Gould A. Andrews et al, Feb., 314
- pathological changes following intracavitary therapy with colloidal Au^{198} (ab), Ralph M. Kniseley and Gould A. Andrews, Feb., 315
- radioactive gold in malignant effusions (ab), J. Walter, April, 637
- use of radioactive colloidal gold in treatment of serous effusions of neoplastic origin (ab), J. P. Storaasli et al, April, 637

tumors

- solitary mesotheliomas (ab), Hector W. Benoit, Jr., and Lauren V. Ackerman, Feb., 286

PLEURISY**with effusion**

- localized interlobar effusion in congestive heart failure (ab), William Weiss et al, April, 612
- loculated azygos fissure effusion in cardiac failure (ab), Robert L. Friedman, Jan., 133
- right-sided traumatic diaphragmatic hernia simulating pleural effusion (ab), S. M. Unger, Jan., 140

PLUMBAGE. See Tuberculosis, Pulmonary, surgical therapy**PLUTONIUM**

- fate and pathologic effects of plutonium metal implanted into rabbits and rats (ab), Hermann Lisco and Walter E. Kisilewski, Jan., 157

PNEUMOCHOLECYSTITIS. See Gallbladder, diseases**PNEUMOCONIOSIS**

- anthracosis occurring in foundry employee (ab), L. E. Hamlin, March, 447
- changes in bronchi in silicosis and silicotuberculosis (ab), G. Worth and W. Heinz, Jan., 128
- chronic pneumoconiosis and rheumatism (ab), E. Martin and G. H. Faillet, June, 897
- cyst formation in graphite pneumoconiosis (ab), H. Müller, June, 897
- lung structure in roentgenograms of rare pneumoconioses (ab), R. Haubrich and B. Schuler, Jan., 129

PNEUMOENCEPHALOGRAPHY. See Brain; Pituitary Body**PNEUMOGRAPHY****See also Meninges, tumors**

- extraperitoneal pneumography (ab), Donald R. Smith et al, Jan., 148
- perirenal air insufflation by paracoccygeal method (ab), Samuel H. Rothfeld et al, March, 463
- perirenal insufflation with arteriography (ab), Frank C. Hamm and Harrison C. Harlin, June, 910
- pneumoretroperitoneum in tumors of adrenals (ab), R. Haubrich and P. Thurn, April, 629
- presacral oxygen injection (ab), Fred Lerman et al, June, 910
- presacral perirenal pneumography (ab), Laurence F. Tinckler, Feb., 304

PNEUMONECTOMY. See Emphysema, pulmonary**PNEUMONIA**

- pseudosyphilitic (Wassermann-positive) virus pneumonia: experiences with 37 cases from 1940 to 1952 (ab), H. Herzog and W. Pulver, Jan., 128

PNEUMONITIS

- treatment of radiation pneumonitis with cortisone (ab), Sanford G. Bluestein and Jacob Roemer, Jan., 159

PNEUMONOLYSIS. See Tuberculosis, Pulmonary, surgical therapy**PNEUMOPERITONEUM**

- in perforated peptic ulcer: factors in roentgenographic demonstration (ab), Walter Gaines, April, 619
- in radiologic diagnosis of cardiac and paracardial tumors of stomach (ab), Carlo Meneghini and Renato de Marchi, Jan., 136
- pneumostratigraphic study of stomach (ab), Mario Mondello and Armando Barone, April, 616

PNEUMORETROPERITONEUM. See Pneumography**PNEUMOSTRATIGRAPHY.** See Body Section Roentgenography**PNEUMOTHORAX.** See Tuberculosis, Pulmonary**POBIRS, FREDERICK W.** See JAFFE, HENRY L.**POCH, ROBERT.** See HOLYI, YURYI**POCHIN, E. E., FARMER, F. T., WALLACE, D. M., TAYLOR, SELWYN, and WALTON, R. J.:** Discussion on the use of radioisotopes in surgery (ab), Feb., 311**POER, DAVID H.:** Primary carcinoma of the third portion of the duodenum (ab), April, 620**POINTILLART, J.** See DELARUE, J.**POLLACK, HERBERT C., and BRIDGMAN, CHARLES F.:****X-rays in ophilety, Feb., 259****POLYARTHRITIS.** See Arthritis, Rheumatoid**POLYPL.** See Tumors, polypoid**POLYVINYL PYRROLIDONE**

- shock, toxemia in radiation lethality (ab), Roberts Rugh et al, June, 922

PONS. See Brain**POPPE, HANNO.** See KANITZ, HELMUT R.**POPPEL, MAXWELL H.:** Roentgen manifestations of relapsing pancreatitis, April, 514**POPPEL, JAMES L., REYES, VICTOR, and HORRAX, GILBERT:** Colloid cysts of the third ventricle. Report of seven cases (ab), March, 442**PORTAL VEIN**

- evaluation of radiologic visualization of spleno-portal vein (spleno-portography) (ab), A. Cacciari and A. Frassinetti, April, 630
- portal phlebography by transperitoneal parenchymatous splenic injection (ab), L. Leger et al, March, 466
- proof of esophageal varices and their clinical significance in portal hypertension (ab), François Robert and Theo Hoffman, May, 774
- splenic-portal venography: technic utilizing percutaneous injection of radiopaque material into spleen (ab), Henry T. Bahnson et al, Feb., 305

PORTMANN, U. V., and McCULLAGH, E. PERRY: Developmental defects following irradiation of the ovaries in a child (ab), Jan., 158**POSSATI, L.:** Importance of abdominal aortography in the study of ischemic syndromes of the lower limbs (ab), April, 629**POTASSIUM**

- comparison of potassium⁴², rubidium⁸⁶, and cesium¹³⁷ as tracers of potassium in study of cation metabolism of human erythrocytes in vitro (ab), William D. Love and George E. Burch, Jan., 157

POTTER-BUCKY DIAPHRAGMS. See Roentgen Rays, physics**POWELL, W. N.** See SEEDORF, E. E.**POWER, MARSCHELLE H.** See MORTENSEN, JD**PRANTAL**

- gastric emptying time: comparative studies with placebos, Prantal and Banthine (ab), G. Kenneth Hawkins et al, April, 17

PRATHER, GEORGE C., and SINGISER, JAMES A.: The urological importance of radiopaque appendiceal concretions (ab), March, 465**PRATT, T. L. C.:** Meconium peritonitis (ab), May, 779**PREGNANCY****See also Craniometry; Labor; Pelvis; Placenta; etc.**

- advantages of x-ray diagnosis in pregnancy (ab), Robert H. Barter and John Parks, May, 785
- blood volume in pregnancy as determined by P^{32} labeled red blood cells (ab), Nathan I. Berlin et al, June, 917
- effect of pre-eclamptic toxemia on exchange of sodium in body and transfer of sodium across placenta measured by Na^{24} tracer methods (ab), L. Woodrow Cox and T. A. Chalmers, Feb., 316

PREGNANCY—cont.

- routine x-ray examination of chest in antenatal clinic (ab), Audrey Freeth, Jan., 131
- volvulus of small intestine complicating pregnancy; case (ab), Phillip H. Halperin et al, May, 778
- ectopic**
 - unruptured tubal term pregnancy (ab), Kurt G. Frachtman, May, 786

PRISCOLINE

- effect of Priscoline on clearance of radiosodium from muscle and skin of man in normal and diseased limbs (ab), Jack Freund et al, May, 796

PROCTOR, BERNARD E. See **DAVISON, SOL****PROSTATE**

- osteomyelitis of spine following prostatic surgery, Edward De Feo, March, 396
- treatment of moderately advanced carcinoma with radioactive gold (ab), H. Dabney Kerr et al, April, 637

PROTECTION. See **Radioactivity**; **Roentgen Rays**, **protection against****PROTEINS**

- See also **Blood**, **proteins**; **Lipoproteins**
- endocardial fibroelastosis; unusual case with impaired ability to fabricate serum proteins (ab), Ben E. Katz and Forrest H. Adams, May, 773
- experimental acute radiodermatitis following beta irradiation. III. Changes in water, fat, and protein content (in skin) (ab), C. C. Lushbaugh and D. B. Hale, June, 919

PRYDE, ARTHUR W., and PENDERGRASS, EUGENE P.: An experimental study of the gastric wall thickness at the site of peristalsis in dogs, April, 559**PSENNER, L.:** Some rare diseases of the maxillary sinus (ab), March, 443**PSEUDOALBUMINURIA**

- Telepaque and pseudoalbuminuria (ab), E. E. Seedorf et al, June, 905

PSEUDOFRACTURES. See **Bones**, **diseases****PSEUDOHERMAPHRODITISM.** See **Hermaphroditism****PSORIASIS**

- psoriatic arthritis (ab), Eugene H. Sterne, Jr., and Benjamin Schneider, Jan., 140

PSYCHOSES

- histoplasmin and tuberculin study of psychiatric patients having abnormal chest roentgenograms (ab), Millard A. Troxell, Jan., 128

PUBIC BONE

- osteitis ischii and pubis following abdominoperineal resection for carcinoma of rectum; case, Alexander Lewitan and Louis Nathanson, March, 402
- osteitis of traumatic etiology (ab), Raymond J. Adams and Fremont A. Chandler, May, 784

PUCKETT, THOMAS F.: Pulmonary histoplasmosis. A study of twenty-two cases with identification of H. capsulatum in resected lesions (ab), Feb., 285**PUGH, ALBERT E.** See **BARRY, MICHAEL C.****PUGH, DAVID G.** See **MORTENSEN, JD****PULMONARY VALVE**

- roentgen aspects of isolated valvular pulmonic stenosis, S. Gilbert Blount, Jr., Malcolm C. McCord, Seiichi Komesu and Raymond R. Lanier, March, 337

PULVER, W. See **HERZOG, H.****PULVERTAFT, C. N.:** The post-gastrectomy stomach remnant (ab), May, 777**PYELOGRAPHY**

- clinical experiences with new medium (70 per cent Urokon-sodium) in intravenous urography (ab), John E. Byrne and William F. Melick, June, 909
- contrast media for kidneys, heart and vessels, and their toxicity (ab), Carl Sandström, Feb., 303
- distortion of pyelogram by extrarenal lesion: liver abscess distortion (ab), T. M. Yates, Jan., 147
- effect of diphenhydramine (Benadryl) on side-reactions in intravenous urography (ab), Solomon R. Bersack and Thomas E. Whitaker, Jr., March, 403
- experiences with high concentration Urokon for pyelography (ab), Reed M. Nesbitt and Thomas E. Nesbitt, June, 908
- influence of diphenhydramine (Benadryl) on side-effects of Diodone in urography (ab), Ejnar Gilg, Feb., 303
- investigations on backflow in retrograde pyelography: roentgenological and clinical study (ab), Rolf Köhler, Feb., 304
- measurement of contrast medium reflux in retrograde pyelography by means of blood Pyridoniodine determination (ab), G. Möckel and K. Gaede, May, 786
- study of radiation hazard in urology (ab), Robert B. Nagle and Edward L. Peirson, June, 911
- time-marker for urograms (ab), Olof Willner, April, 631
- Urokon Sodium 70 per cent in excretory urography (ab), Carey N. Barry and Dalton K. Rose, April, 628
- use of gastric distention as aid to pediatric urography (ab), David H. Allen, April, 628

PYLORUSSee also **Peptic Ulcer**

- pyloric obstruction due to mucosal diaphragm (ab), Alexander N. Rota, Jan., 137

PYRIDON

- measurement of contrast medium reflux in retrograde pyelography by means of blood Pyridoniodine determination (ab), G. Möckel and K. Gaede, May, 786

Q**QUIMBY, EDITH H.** See **KLIGERMAN, MORTON M.****R****RAAF, JOHN, and CRAIG, WINCHELL McK.:** Diagnosis of tumors of the pituitary body (ab), Jan., 126**RADIATIONS**

- See also **Atomic Bomb**; **Cosmic Rays**; **Radioactivity**; **Radium**; **Roentgen Rays**; etc.
- cellular index of sensitivity to ionizing radiation; sensitization response (ab), Ruth M. Graham and John B. Graham, Feb., 317

- education and training of health physicists, Elda E. Anderson, Jan., 83

- improved clinical dosimeter for measurement of radiation, S. O. Fedoruk, H. E. Johns and T. A. Watson, Feb., 177
- recommendations of International Commission on Radiological Units (ed), Lauriston S. Taylor, Secretary, Jan., 106

effects. See also **Radiations**, **injurious effects**

- action of reducing substances on latent radiation effect in vitro (ab), J. Loiseleur et al, May, 798
- chemical synthesis following action of roentgen rays (ab), A. Lacassagne and J. Loiseleur, May, 799
- experimental studies on effect on ionizing radiation delivered intermittently (ab), Ernst Witte, Jan., 161
- mitotic effects of prolonged irradiation with low-intensity gamma rays on Chortophaga neuroblast (ab), J. Gordon Carlson et al, April, 639
- of midlethal doses of total-body ionizing radiations (ab), Elbert DeCoursey, Jan., 159
- secondary evolution of molecules having a phenol radical, following roentgen irradiation (ab), J. Loiseleur and M. Sauvage, May, 799

injurious effects. See also **Atomic Bomb**; **Plutonium**; **Radioactivity**; **Roentgen Rays**

- control of radiation sickness with dihydroergotamine (ab), K. Werner, March, 475
- discussion on radiation syndrome (ab), W. M. Court Brown et al, Feb., 317
- focal scleral necrosis: a late sequel of irradiation (ab), Ira S. Jones and A. B. Reese, April, 639
- investigation into relationship between physiologically low leukocyte counts and sickness absence (ab), Frances M. Turner, June, 920
- local enzymatic treatment of radiation necrosis of skin (ab), Sven Hulthberg, Feb., 320

protection against

- influence of homologous tissue factors on DNA turnover and radiation protection (ab), Lola S. Kelly and Hardin B. Jones, Jan., 162

RADIOACTIVITY

- See also **Atomic Bomb**; **Plutonium**; **Radiations**
- discussion on use of isotopes in neurology (ab), W. V. Mayneord et al, Feb., 312
- discussion on use of radioisotopes in surgery (ab), E. E. Pochin et al, Feb., 311

- dosimetry of beta radiations, Robert Loevinger, Jan., 74

- encouraging and discouraging research with therapeutic radioisotopes (ab), Marshall Brucer, April, 635

- film measurement of beta-ray depth dose (ab), E. Tochilin and R. Golden, June, 918

- isotope handling calculator (ab), R. West, June, 918

- monitoring of liquids for radioactivity (ab), W. M. Hurst, June, 918

- National Bureau of Standards Handbook 56. Safe Handling of Cadavers Containing Isotopes, March, 430

- Oak Ridge Institute of Nuclear Studies (basic techniques courses), March, 431

- photographic method of determining distribution of radioactive material in vivo (ab), Sven A. E. Johansson and Bengt Skanse, Feb., 313

- radioisotope procedures with laboratory animals (ab), Sam L. Hansard and C. L. Comar, June, 919

- size of dose: its effect on distribution in body (ab), Herbert E. Stokinger, Feb., 313

- teletherapy design problems, Marshall Brucer, Jan., 91

radioarsenic

- biological studies with arsenic⁷⁶: IV. Histopathologic effect of arsenic⁷⁶ upon hematopoietic tissues of patients with leukemia (ab), Matthew Block et al, Feb., 316

radioberyllium

- distribution and retention of carrier-free radioberyllium in rat (ab), C. D. Van Cleave and C. T. Kaylor, March, 475

radiocarbon

- distribution and excretion of radioactive Isoniazid in tuberculous patients (ab), W. R. Barclay et al, Feb., 315

radiocesium

- comparison of potassium⁴², rubidium⁸⁶, and cesium¹³⁷ as tracers of potassium in study of cation metabolism of human erythrocytes in vitro (ab), William D. Love and George B. Burch, Jan., 157

radiochloride

- chloride "space" and total exchanging chloride in man measured with long-life radiochloride, Cl³⁶ (ab), S. A. Threefoot et al, May, 795

radiocobalt

- dosimetry of kilocurie cobalt-60 source (ab), Sol Davison et al, June, 918

- economical shielding for multicurie sources (ab), R. F. Obrycki et al, June, 919

RADIOACTIVITY, radiocobalt—cont.

- effect of chamber voltage on electron build-up measurements, Jasper E. Richardson, April, 584
- effect of cobalt-60 gamma radiation on passive immunity (ab), William M. Hale and Richard D. Stoner, Feb., 316
- experiences in endovesical irradiation of bladder tumors with liquid radioactive cobalt (ab), Walter Bessler, May, 794
- intrathoracic irradiation of hilum after resection for bronchial carcinoma; preliminary report (ab), W. E. J. Schneiderzik, Jan., 151
- irradiation of cancer of uterine cervix with radioactive cobalt 60 in guided aluminum needles and in plastic threads (ab), Joseph L. Morton et al., March, 473
- lethal dose studies with burros and swine exposed to whole-body cobalt-60 irradiation, John H. Rust, Bernard F. Trum, James L. Wilding, Charles S. Simons and C. L. Comar, April, 569
- primary carcinoma of mastoid process; case (ab), Russell G. Means and John Gersten, Jan., 156
- production of multicentric gamma-ray teletherapy sources (ab), D. T. Green et al., March, 472
- Saskatchewan 1,000-curie cobalt 60 unit, T. A. Watson, H. E. Johns and C. C. Burkell, Feb., 165
- simplified automatic isodose recorder (ab), A. Cole et al., Feb., 311
- standard cobalt 60 teletherapy source capsule, June, 878
- studies on effects of continuous exposure of animals to gamma radiation from cobalt 60 plane sources (ab), John F. Thomson et al., March, 474
- use of cobalt 60 in gamma-ray therapy (ab), E. M. Japha, March, 473
- radiocolchicine**
 - studies with radioactive colchicine. I. Influence of tumors on tissue distribution of radioactive colchicine in mice (ab), A. Back and E. J. Walaszek, May, 796
- radiofluorescein.** See Brain, tumors
- radiogold**
 - colloidal gold in carcinoma of cervix (ab), S. D. Soule, April, 637
 - experimental observations on local tumor therapy with radiogold (ab), Helmut R. Kanitz et al., May, 794
 - hypoplasia of bone marrow associated with radioactive colloidal gold therapy (ab), Thomas W. Botsford et al., Jan., 155
 - in malignant effusions (ab), J. Walter, April, 637
 - intracavitary colloidal radiogold in treatment of effusions caused by malignant neoplasms (ab), Gould A. Andrews et al., Jan., 155
 - localization of radioactivity in regional lymph nodes (ab), Harold F. Berg et al., May, 795
 - lymphatic drainage following intrabronchial instillation of silver-coated radioactive gold colloids in therapeutic quantities (ab), F. F. Hahn and E. L. Carothers, Jan., 155
 - metabolism and distribution of colloidal Au¹⁹⁸ injected into serous cavities for treatment of effusions associated with malignant neoplasms (ab), Gould A. Andrews et al., Feb., 314
 - pathological changes following intracavitary therapy with colloidal Au¹⁹⁸ (ab), Ralph M. Knisley and Gould A. Andrews, Feb., 315
 - radiogold seeds for cancer therapy (ab), Ulrich K. Henschke et al., March, 473
 - removal of colloid by perfused mammalian liver (ab), Robert C. Little and Herbert B. Kelly, March, 475
 - syringe shield used in injecting radioactive gold (ab), Paul Getzoff et al., June, 918
 - treatment of meningeal system by means of colloidal gold and x-rays (ab), Charles L. Lewis, June, 914
 - treatment of moderately advanced carcinoma of prostate (ab), H. Dabney Kerr et al., April, 637
 - use of colloidal Au¹⁹⁸ for obtaining scintigrams of liver (ab), Eric T. Yuhl et al., Feb., 315
 - use of colloidal gold in treatment of serous effusions of neoplastic origin (ab), J. P. Storaasli et al., April, 637
- radioiodine.** See also Goiter; Thyroid
 - behavior of iodide¹³¹ in guinea-pigs and of I¹³¹ rabbit globulin in guinea-pigs and rabbits (ab), S. P. Masouredis et al., Jan., 156
 - concomitant in vivo measurement of erythrocyte and plasma concentrations using I¹³¹ and P³² (ab), Allen F. Reid and Ben Wilson, March, 474
 - deposition of airborne vapor (ab), A. C. Chamberlain and R. C. Chadwick, June, 916
 - in treatment of advanced heart disease: end results in 100 patients (ab), Henry L. Jaffe et al., Jan., 154
 - jet injection of radioisotopes: clinical study comparing needle and jet injection of I¹³¹, K⁴² and Na²⁴ (ab), Franz K. Bauer et al., Feb., 313
 - metabolism of I¹³¹-labeled thyroxine—studies with isolated, perfused rat liver (ab), F. N. Briggs et al., Jan., 157
 - multiple-counter system for isotope encephalometry (ab), Douglas A. Kohl, June, 916
 - new technic for diagnosis of carcinoma metastatic to liver; preliminary report (ab), Lloyd A. Stirrett et al., Jan., 139
 - radioactive iodine-labeled fat (ab), M. C. Hoffman, Feb., 314
- radioiridium**
 - improved iridium¹⁹² teletherapy unit (ab), H. F. Freundlich and J. L. Haybittle, Jan., 156
 - use of radioactive isotopes in applicator for treatment of carcinoma of cervix uteri (ab), Robert C. Tudway, March, 472

radioiron

- absorption of iron. Radioiron studies in idiopathic hemochromatosis, malnutritional cytosiderosis, and transfusional hemosiderosis (ab), T. H. Bothwell et al., April, 638
- erythrocyte life span in small animals: comparison of two methods employing radioiron (ab), E. Langdon Burwell et al., Jan., 158
- investigations to determine union of iron with beta globulin and its clinical significance with aid of Fe⁵⁹ (ab), F. Wuhrmann and B. Jasiński, June, 917

radiophosphorus

- blood volume in pregnancy as determined by P³² labeled red blood cells (ab), Nathaniel I. Berlin et al., June, 917
- concomitant in vivo measurement of regional erythrocyte and plasma concentrations using I¹³¹ and P³² (ab), Allen F. Reid and Ben Wilson, March, 474
- deposition in fractured bones in rats (ab), G. W. Wilkinson and C. P. Leblond, June, 917
- diagnosis of breast cancer with P³² (ab), K. L. Bhattacharya et al., May, 793
- experimental acute radiodermatitis following beta irradiation. I. Its pathogenesis and repair (ab), C. C. Lushbaugh et al., June, 919
- experimental acute radiodermatitis following beta irradiation. II. The inhibition of fibroplasia (ab), C. C. Lushbaugh and J. B. Storer, June, 919
- experimental acute radiodermatitis following beta irradiation. III. Changes in water, fat and protein content (ab), C. C. Lushbaugh and D. B. Hale, June, 919
- studies on blood-brain barrier with radioactive phosphorus. III. Embryonic development of barrier (ab), Louis Bakay, May, 795
- uptake of P³² by cardiac muscle in vivo (ab), Julian B. Marsh et al., March, 475

radiopotassium

- comparison of potassium⁴², rubidium⁸⁶, and cesium¹³⁴ as tracers of potassium in study of cation metabolism of human erythrocytes in vitro (ab), William D. Love and George E. Burch, Jan., 157
- jet injection of radioisotopes: clinical study comparing needle and jet injection of I¹³¹, K⁴², and Na²⁴ (ab), Franz K. Bauer et al., Feb., 313

radiorubidium

- comparison of potassium⁴², rubidium⁸⁶, and cesium¹³⁴ as tracers of potassium in study of cation metabolism of human erythrocytes in vitro (ab), William D. Love and George E. Burch, Jan., 157

radioruthenium

- effect of intragastric irradiation on gastric acidity in dog (ab), Benum W. Fox et al., May, 797

radiosodium. See also Placenta

- effect of Priscoline on clearance of radiosodium from muscle and skin of man in normal and diseased limbs (ab), Jack Freund et al., May, 796
- in vitro studies of aspects of metabolism of sodium by human erythrocytes using sodium (ab), William D. Love and George E. Burch, Jan., 158
- jet injection of radioisotopes: clinical study comparing needle and jet injection of I¹³¹, K⁴², and Na²⁴ (ab), Franz K. Bauer et al., Feb., 313

radiostrontium

- effect of intragastric irradiation on gastric acidity in dog (ab), Benum W. Fox et al., May, 797
- experimental acute radiodermatitis following beta irradiation. I. Its pathogenesis and repair (ab), C. C. Lushbaugh et al., June, 919
- experimental acute radiodermatitis following beta irradiation. IV. Changes in respiration and glycolysis (ab), C. C. Lushbaugh and D. B. Hale, June, 919
- experimental acute radiodermatitis following beta irradiation. V. Histopathological study of mode of action of therapy with Aloe vera (ab), C. C. Lushbaugh and D. B. Hale, June, 919

radiosulfur

- autoradiography of mast cells in experimental skin tumors of mice injected with radioactive sulfur (S³⁵) (ab), G. Asboe-Hansen, May, 795

RADIOCARPAL JOINT. See Wrist**RADIODERMATITIS.** See Radioactivity**RADIOISOTOPES.** See Radioactivity**RADIOLOGICAL SOCIETIES**

- See also American College of Radiology; Inter-American Congress of Radiology; International Congress of Radiology; Radiological Society of North America
- American Radium Society, June, 878
- Central Ohio Radiological Society, Feb., 273
- Florida Radiological Society, June, 878
- Greater Miami Radiological Society, March, 430
- Indian Radiological Society, Jan., 110
- Indiana Roentgen Society, June, 878
- Kansas Radiological Society, Jan., 110; May, 754
- Kentucky Radiological Society, March, 430
- Los Angeles Radiological Society, Jan., 110
- Maine Radiological Society, Jan., 110
- New York Roentgen Society, April, 596
- Ohio State Radiological Society, March, 430
- Pennsylvania Radiological Society, April, 596
- Radiation Research Society, Feb., 273
- Richmond County (Georgia) Radiological Society, March, 430
- Rochester Roentgen Ray Society, April, 596
- Rocky Mountain Radiological Society, June, 878
- St. Louis Society of Radiologists, March, 430

RADIOLOGICAL SOCIETIES—cont.

- San Francisco Radiological Society, Jan., 110
secretaries and meeting dates, Jan., 117, Feb., 274; March, 435; April, 599; May, 757; June, 881
Tri-State Radiological Society, May, 754
Utah State Radiological Society, March, 430
Westchester Radiological Society, May, 754

RADIOLOGICAL SOCIETY OF NORTH AMERICA

- Pendergrass, Eugene P., president (ed), Robert P. Barden, Feb., 263

thirty-ninth annual meeting

- (ed), Feb., 264
—Carman lecture: Observations in atomic medicine, Roger A. Harvey, April, 479
—commercial exhibits, Feb., 268
—presidential address: Trends in modern medicine, (ed), Ira H. Lockwood, March, 427
—refresher courses, Feb., 266
—scientific exhibits, Feb., 266

RADIOLOGY AND RADIOLOGISTS

- pediatric radiology (ab), Edward B. D. Neuhauser and Martin H. Wittenborg, May, 791
—radiology in small community, Edw. D. Greenberger, Jan., 88
—wide-angle trifocal eyeglasses for radiologists, D. Alan Sampson, Feb., 255

RADIUM

- See Radiations; Radon; Uterus, cancer; etc.
—effect of intragastric irradiation on gastric acidity in dog (ab), Benum W. Fox et al, May, 797
—gamma-ray output of radium (ab), A. Ghosh et al, April, 638
—hazard evaluation and control after spill of 40 mg. of radium (ab), R. K. Skow et al, June, 921
—investigation of radium deposition in human skeleton by gross and detailed autoradiography (ab), William B. Loney and L. A. Woodruff, May, 797
—simplified automatic isodose recorder (ab), A. Cole et al, Feb., 311

RADIUS

- See also Wrist
—epiphyseal injuries of radial head and neck (ab), Sawnie R. Gaston et al, Jan., 144
—rare dislocations and fracture-dislocations (ab), H. Fietz, March, 459

RADON

- inhalation studies in rats (ab), S. H. Cohn and J. K. Gong, May, 798
—sampling and measurement of airborne daughter products of radon (ab), John H. Harley, June, 922

- RAFFENSPERGER, EDWARD C.:** Multiple gastric ulcers occurring during Phenylbutazone therapy (ab), March, 454

RAGNAR, ROMANUS. See MORALES, OLALLO**RAGNHULT, INGER. See EGMARK, A.****RAMAMURTHY, B. See REDDY, D. GOVINDA****RAMBAR, ALWIN C. See LEVIN, BERTRAM****RAEMEY, WILLIAM P. See PEIRCE, E. CONVERSE, II****RAMOS, MIGUEL, and MOUNT, LESTER A.:** Carotid cavernous fistula with signs on contralateral side. Case report (ab), Jan., 127**RAMSAY, BEATTY H.:** Mucocoele of the lung due to congenital obstruction of a segmental bronchus: a case report; relationship to congenital cystic disease of the lung and to congenital bronchiectasis (ab), May, 767**—and BYRON, FRANCIS X.:** Mucocoele, congenital bronchiectasis, and bronchiogenic cyst (ab), April, 608**RAND, ROBERT W., and LEMMEN, LLOYD J.:** Tumors of the posterior portion of the third ventricle (ab), Jan., 124**RANDALL, ROBERT G. See BAXTER, HAMILTON****RANDELL, HERBERT T., Jr., and ELLISON, ROBERT G.:** Volvulus of a lobe of the lung as a complication of diaphragmatic hernia. Case report (ab), Feb., 284**RASCOE, ROBERT R. See JAVERT, CARL T.****RAVDIN, I. S., and HORN, ROBERT C., Jr.:** Gastric ulcer and gastric cancer (ab), April, 618**RAWSON, ARNOLD J., and FRANK, JOE L., Jr.:** Treatment by irradiation of lymphangiosarcoma in postmastectomy lymphedema. Report of a case (ab), Feb., 308**RAY, C. T. See THREEFOOT, S. A.****REAY, E. R., and ROLLESTON, G. L.:** Hydatid cyst of the kidney. A report of two cases (ab), March, 464**RECKLINGHAUSEN'S DISEASE. See Neurofibromatosis****RECTUM****—adenomas of colon and rectum: diagnosis and treatment in relation to cancer prevention (ab), Paul C. Morton, May, 778****—osteitis ischii and pubis following abdominoperineal resection for carcinoma of rectum; case, Alexander Levitan and Louis Nathanson, March, 402****REDDY, D. GOVINDA, and RAMAMURTHY, B.:** Ventriculographic changes in cysticercosis of the brain (ab), May, 764**REDO, S. FRANK.:** Spinal complications following lumbar puncture. A review of the literature and report of four cases (ab), March, 461**REESE, A. B. See JONES, IRA S.****REEVES, ROBERT J., and PEDERSEN, ROBERT.:** Fungous infection of bone, Jan., 55**—See TEXTER, E. C., Jr.****REHERMANN, ROBERT L. See AXLER, MORTON M.****REICHENMILLER, H., and DRESCHER, H.:** Is the five-year cure of carcinoma of the cervix a permanent cure?

- A contribution to the problem of control (ab), March, 470
REID, ALLEN F., and WILSON, BEN.: Concomitant in vivo measurement of regional erythrocyte and plasma concentrations using I^{131} and P^{32} (ab), March, 474

- REID, F.:** Placentography. Symposium. V. Radiological localization of the placenta (ab), June, 908

- REID, JOHN H. See SALZMAN, EMANUEL.**

- REINHARDT, K.:** Concerning a case of pulmonary lymphangectasis (ab), March, 447

- REISS, JACK, BAUM, GEORGE L., and KOVNAV, MAURICE.:** The early recognition and treatment of bronchogenic carcinoma (ab), March, 445

RESEARCH

- Radiation Research Society, Feb., 273

RESPIRATORY TRACT

- See also Bronchi; Lungs; etc.
—respiratory disorders among welders (ab), Robert Charr, May, 770

RETICULOENDOTHELIAL SYSTEM

- histiocytosis X. Integration of eosinophilic granuloma of bone, "Letterer-Siwe disease," and "Schüller-Christian disease" as related manifestations of single nosologic entity (ab), Louis Lichtenstein, May, 782

- RETOTHEL SARCOMA. See Sarcoma, reticulosarcoma**

- RETROPERITONEUM. See Abdomen**

- REYES, VICTOR. See POPPEN, JAMES L.**

- REYNOLDS, LAWRENCE, honored, April, 596**

RHEUMATIC FEVER

- radiological diagnosis of rheumatic pericardial effusion (ab), E. M. M. Besterman and G. T. Thomas, Feb., 289

RIBS

- rib notching following subclavian artery obstruction, Bertram Levin and Leo G. Rigler, May, 660
—source of potential error in roentgen diagnosis of cervical ribs, D. R. Keating and J. R. Amberg, May, 688

- RICHARDS, H. G. H. See GOLDEN, G. N.**

- RICHARDSON, JASPER E.:** Effect of chamber voltage on electron build-up measurements, April, 584

- RICHMAN, SAMUEL, and FRIEDMAN, ROBERT L.:** Vertical fracture of cervical vertebral bodies, April, 536

- RICHTER, HS. R.:** Collaterals between the external carotid artery and the vertebral artery in cases of thrombosis of the internal carotid artery (ab), June, 889
Phlebography in brainstem tumours (ab), June, 890

- RIES, JULIUS. See EYMER, HEINRICH**

- RIESSNER, D. See GVOZDANOVIC, V.**

- RIGGS, HELEN E. See HODES, PHILIP J.**

- RIGLER, LEO G. See LEVIN, BERTRAM**

- RILEY, EDGAR A. See WERMER, PAUL**

- RIMINI, RICARDO, RODRIGUEZ, ABELARDO, BURGOS, RAUL, DUOMARCO, JOSE, SAPRIZA, JOSE, and SURRACO, GERMAN H.:** Contribution of angioneuromatography to some problems of pulmonary physiopathology (ab), March, 444

- RITCHIE, WALLACE P., and HAINES, GERALD.:** Spontaneous intracranial hemorrhage in children. Report of eight cases in children fifteen years of age or younger (ab), Feb., 282

- RIZZOLI, HUGO V. See BERSACK, SOLOMON R.**

- ROBBINS, LAURENCE L., and WYMAN, STANLEY M.:** Coarctation of the thoracic aorta. Signs demonstrable by conventional roentgenography (ab), Feb., 289

- ROBERT, FRANCOIS, and HOFFMANN, THEO.:** The proof of esophageal varices and their clinical significance in portal hypertension (ab), May, 774

- ROBERTS, MORTON. See WEINSTEIN, MANDEL**

- ROBINSON, WILLIAM H., honored, March, 430**

- ROCHE, G., HOUPEAU, MME., and ODABACHIAN, M.:** Mobile floating fibrin bulla in the course of a hydropneumothorax (ab), Jan., 131

- RODRIGUEZ, ABELARDO. See RIMINI, RICARDO**

- ROEMER, JACOB. See BLUESTEIN, SANFORD G.**

ROENTGEN RAYS

- See also Betatron; Body Section Roentgenography; Cine-radiography; Radiations; Roentgen Therapy

- chemical, mineralogic, and x-ray diffraction investigation of gallstones of man and cattle (ab), W. Epprecht et al, May, 780

- pathology of urinary calculi (diffraction studies): radial striation (ab), J. A. Carr, Jan., 147

- x-ray absorption and diffraction studies on experimental vesical calculi (ab), I. Hedenberg et al, Jan., 147

- x-rays in phylately, Herbert C. Pollack and Charles F. Bridgman, Feb., 259

apparatus

- body-section radiographic equipment: modifications and accessories, W. Berkeley Zinn, March, 416

- carotid angiography with Urokon, using Chamberlain bip-plane stereoscopic angiographic unit; 100 cases (ab), Paul Lin et al, May, 766

- for serial angiography (ab), S. E. Sjögren and Georg Fredzell, June, 893

- homemade inexpensive manual rapid cassette changer for angiocardiology and cerebral angiography, Kenneth W. Taber, May, 728

- inexpensive semi-automatic serialangiographic apparatus for angiography (ab), Gregory B. Nichols, March, 444

- multifilm cassette for use in laminography (ab), Waldron M. Sennott and Howard E. Worrell, May, 789

- simple centering device for radiographic tubes (ab), Ove Mattsson, May, 789

- time-marker for urograms (ab), Olof Willner, April, 631

ROENTGEN RAYS—cont.

- effects.** See also Radiations, effects; Roentgen Rays, injurious effects
- absorption of x-rays by tissues of head and neck, M. G. Wheatcroft and J. E. Morgan, March, 423
 - comparison of pathologic effects of radiation in weanling and adult rats (ab), George W. Casarett, March, 476
 - control of postirradiation hemorrhagic state by platelet transfusions (ab), M. C. Woods et al, April, 639
 - cytological changes following roentgen irradiation of liver in mice (ab), M. E. Wilson and R. E. Stowell, Feb., 318
 - effect of 2,000 r local irradiation on metabolism and alkaline phosphatase activity of rat bone (ab), S. H. Cohn and J. K. Gong, Feb., 319
 - effect of x-ray to kidney on renal function of dog (ab), Mortimer L. Mendelsohn and Eduardo Caceres, March, 476
 - effects of fractionated doses of radiation on normal and tumor tissue (ab), L. C. Fogg and R. F. Cowing, Feb., 318
 - experimental infection and streptomycin treatment in irradiated mice (ab), Robert Q. Marston et al, Jan., 161
 - influence of roentgen rays upon development of mouse by local irradiation of some parts of body (ab), V. V. Brunst and Frank H. J. Figue, Feb., 319
 - naturally occurring infections in untreated and streptomycin-treated x-irradiated mice (ab), Leon Gonschery et al, Jan., 160
 - occurrence of pulmonary tumors in Strain A mice following total-body x-radiation and injection of nitrogen mustard (ab), W. E. Heston et al, May, 799
 - of total-body irradiation on peripheral blood of monkey (ab), Earl Eldred and Bergliot Eldred, Jan., 161
 - of total-body irradiation upon lipoprotein metabolism (ab), John E. Hewitt et al, Jan., 161
 - of whole-body irradiation on urinary B-vitamin excretion of rats (ab), W. N. Pearson et al, Feb., 319
 - on laryngotracheal lymph vessels (ab), Claudio Sbernini and Ivo Orlandini, March, 476
 - on nuclease activity and respiration of *Tetrahymena geleii* W. (ab), Herbert J. Eichel and Jay S. Roth, April, 639
 - on *Trichina larvae* (ab), S. E. Gould et al, Jan., 162
 - prophylactic antibiotic therapy in irradiated animals (ab), Willie W. Smith et al, Jan., 160
 - protecting action of citrate on agent of chicken Tumor I (Rous sarcoma virus) during roentgen radiation in vitro (ab), W. Ray Bryan et al, May, 798
 - radiation sickness in monkey, Earl Eldred and William V. Trowbridge, Jan., 65
 - reduction of mortality in swine from combined total-body radiation and thermal burns by streptomycin (ab), Hamilton Baxter et al, April, 640
 - roentgen cataract: effects of shielding lens and ciliary body (ab), A. J. Alter and P. J. Leinfelder, Jan., 158
 - roentgen rays and wound healing; experimental study (ab), Walter Lawrence, Jr., et al, Jan., 162
 - shock, toxemia in radiation lethality (ab), Roberts Rugh et al, June, 922
 - treatment of acute radiation syndrome in dogs with Aureomycin and whole blood (ab), Frank W. Furth et al, April, 639
- fluoroscopy.** See also Cineradiography
- radiation dosage to female genital tract during fluoroscopic procedures, H. Stephen Weems, J. Luther Clements and John H. Tolan, May, 745
- injuries.** See also Radiations, injurious effects; Roentgen Rays, effects; Roentgen Rays, fluoroscopy; Roentgen Rays, protection against
- bone marrow changes in patients with chronic leukemia treated by splenic x-irradiation; preliminary report (ab), F. W. Gunz, June, 921
 - brain necrosis following x-ray therapy (ab), Eldon L. Foltz et al, May, 796
 - developmental defects following irradiation of ovaries in child (ab), U. V. Portmann and E. Perry McCullagh, Jan., 158
 - experimental studies. See Roentgen Rays, effects
 - fractures of femoral neck after x-ray therapy for carcinoma of female genital tract (ab), Heinz Kirchhoff and Gert Imholz, March, 475
 - radiation burns from diffraction apparatus simulating infections; cases (ab), R. M. Watrous et al, April, 638
 - study of radiation hazard in urology (ab), Robert B. Nagle and Edward L. Peirson, June, 911
 - treatment of radiation pneumonitis with cortisone (ab), Samuel G. Bluestein and Jacob Roemer, Jan., 159
- physics**
- some physical characteristics of Potter-Bucky diaphragms, H. E. Seemann and H. R. Spilletsosser, April, 575
- protection against**
- protection of irradiated rats by parabiosis with adrenalectomized or splenectomized partners, Martin Schneider, Robert C. Wybourn, Robert Binhammer and John C. Finerty, Feb., 234
- stereoscopy.** See Roentgen Rays, apparatus
- technic.** See also Body Section Roentgenography
- dichromatic absorption radiography. Dichromography (ab), Bertil Jacobson, April, 630
 - method of tumor localization and field positioning in radiotherapy, H. D. Jamieson, Feb., 195
 - orthoroentgenography (ab), G. Schaltenbrand, May, 789
- ROENTGEN THERAPY**
- See also Cancer; Roentgen Rays, effects; Roentgen Rays, injurious effects; under organs and regions
- improved light localizer for x-ray therapy, Leonard G. Grimm, Gilbert H. Fletcher and E. B. Moore, April, 589
 - rotation therapy technics applicable to standard deep-x-ray machines, Morton M. Kligerman, Elaine G. Rosen and Edith H. Quimby, Feb., 185
 - simple scheme for deriving x-ray skin-surface dose times (ab), Russell A. Langley, March, 467
 - system of dosimetry for rotation therapy with typical rotation distributions (ab), H. E. Johns et al, March, 472
 - use of conventional depth-dose tables in divided-port x-ray therapy: transmarginal radiation and depth-dose distribution, Gerhart S. Schwarz and A. R. Islam, May, 733
- high-voltage**
- experience with 2 million volt x-ray therapy and a preliminary assessment of clinical results (ab), G. W. Blomfield, Feb., 310
 - fourteen years of supervoltage therapy in Swedish Hospital, Seattle, U. S. A. (ab), F. Buschke, June, 913
- ROENTGENOLOGY AND ROENTGENOLOGISTS.** See Gallbladder; Gastrointestinal Tract; Radiology and Radiologists
- RÖSLI, A.** Occurrence of bipartite or radiale dorsale. Previously unreported accessory bones of the radiocarpal joint (ab), June, 907
- ROGERS, JAMES S.** See BASSETT, ROBERT C.
- ROGERS, LAMBERT.** See LEWIS, CECIL
- ROKITANSKY-ASCHOFF SINUSES.** See Gallbladder
- ROLLESTON, G. L.** See REAY, E. R.
- ROMANUS, RAGNAR.** See MORALES, OLALLO.
- ROOF, BETTY S.** See MARKS, PAUL A.
- ROOT, SAMUEL W.** See ANDREWS, GOULD A.
- ROQUE, FRANCISCO T. LUDWICK, RUSSELL W., and BELL, J. CARROLL.** Pulmonary paragonimiasis: a review with case reports from Korea and the Philippines (ab), April, 609
- ROSCHER, W.** Acanthosis nigricans (ab), May, 790
- ROSE, DALTON K.** See BARRY, CAREY N.
- ROSE, FREDERICK A.** See JOELSON, JAMES J.
- ROSE, WILLIAM.** See KNAUS, WILLIAM E.
- ROSEN, ELAINE G.** See KLIGERMAN, MORTON M.
- ROSENBAUM, HAROLD D. NADAS, ALEXANDER S., and NEUHAUSER, EDWARD B. D.** Primary myocardial disease in infancy and childhood (ab), May, 772
- See NADAS, ALEXANDER S.
- ROSENBAUM, HERBERT E.** See SEAMAN, WILLIAM B.
- ROSENFELD, DAVID D.** See SAWYERS, THOMAS M.
- ROSENFELD, MAURICE H.** See JAFFE, HENRY L.
- ROSENMUND, H.** See EPPRECHT, W.
- ROSS, FREDERICK P.** See WARTHIN, THOMAS A.
- ROSZA, STEPHEN, and GROSS, ROBERT J.** Intrauterine perforation of Meckel's diverticulum (ab), April, 621
- ROTA, ALEXANDER N.** Pyloric obstruction due to mucosal diaphragm (ab), Jan., 137
- ROTATION THERAPY.** See Bronchus, cancer; Roentgen Therapy
- ROTH, JAY S.** See EICHEL, HERBERT J.
- ROTH, L. J.** See BARCLAY, W. R.
- ROTH, LAURENCE G.** A pelvic study. I. The sacrum: its significance in obstetrics (ab), April, 626
- A pelvic study. II. Complete pelvimetry, including the use of a proposed new system of pelvic profile description (ab), April, 626
- Outlet pelvimetry and the symphysis-biparietal and sacral-biparietal diameters (ab), April, 627
- ROTHENBERG, ROBERT E.** Cholecystectomy and its relation to the stomach and duodenum. Review of 75 cases with preoperative and postoperative x-ray studies (ab), Feb., 294
- ROTHFELD, SAMUEL H., HAMM, FRANK C., and HARLIN, HARRISON C.** Perirenal air insufflation by paracoccygeal method (ab), March, 463
- ROTHMANN, BRUCE F.** See STOREY, CLIFFORD F.
- ROTKÓCZY, NÁNDOR.** Cancer of the lungs with metastases in the lungs (ab), June, 895
- ROWE, ALBERT H., ROWE, ALBERT, Jr., and UYEYAMA, KAHN.** Regional enteritis—its allergic aspects (ab), Feb., 293
- ROWE, ALBERT, Jr.** See ROWE, ALBERT H.
- ROWE, R. D., and VLAD, PETER.** Persistent truncus arteriosus. Report of two cases with right aortic arch (ab), June, 899
- See KEITH, JOHN D.
- ROYER, J., and GLOAGUEN, A.** Pseudotumoral pulmonary syphilis (ab), Jan., 128
- RUBIDIUM, RADIOACTIVE.** See Radioactivity
- RUBIN, SIDNEY.** See HALPERIN, PHILLIP H.
- RUBOVITS, FRANK E., COOPERMAN, NORMAN R., and LASB, A. P.** Habitual abortion: a radiographic technique to demonstrate the incompetent internal os of the cervix (ab), May, 785
- RUDOLPH, ABRAHAM M.** See NADAS, ALEXANDER S.
- RÜTTIMANN, A., and SUTER, F.** Tuberculosis of the lung (ab), April, 607
- RUFFIN, J. M.** See TEXTER, E. C., Jr.
- RUGGIERO, GIOVANNI, and CASTELLANO, FRANCESCO.** Upward displacement of the posterior part of the third ventricle. A method for its evaluation (ab), March, 442
- RUGH, ROBERTS, SUESS, JOSEPHINE, and SCUDDER, JOHN.** Shock, toxemia in radiation lethality (ab), June, 922
- RUNCO, ANTONIO, and BOSSI, ROBERTO.** The periosteopathy of mother-of-pearl workers (ab), May, 781

RURAL CONDITIONS

—radiology in small community, Edw. D. Greenberger, Jan., 88

RUSHMER, ROBERT F., CRYSTAL, DEAN K., TIDWELL, ROBERT A., and HENDRON, JOHN A.: Cinefluorographic studies of cardiovascular disease (ab), March, 448

RUST, JOHN H., TRUM, BERNARD F., WILDING, JAMES L. SIMONS, CHARLES S., and COMAR, C. L.: Lethal dose studies with burros and swine exposed to whole body cobalt-60 irradiation, April, 569

RUTH, H. JEANETTE. See SMITH, WILLIE W.

RUTHENIUM, RADIOACTIVE. See RADIOACTIVITY

RYDER, CHARLES T., and CRANE, LAWRENCE: Measuring femoral anteversion: the problem and a method (ab), Feb., 300

S

SACCHI, ADOLFO. See CHIAPPA, SERGIO

SACHS, MAURICE D.: Visualization of the common duct during cholecystography: its significance (ab), March, 455

SACRUM

See also Pelvis

—lumbar and sacral cysts of meningeal origin, Kenneth J. Strully and Saul Heiser, April, 544

—myelographic demonstration of cysts of spinal membranes, Lewis G. Jacobs, James K. Smith and Philip S. Van Horn, Feb., 215

SAGE, HAROLD H. See DOUBLET, HENRY

ST. AUBIN, PAUL M. G. See SCHALL, LEROY A.

SALDANHA, ALEU. See MONIZ de BETTENCOURT, J.

SALIVARY GLANDS

—irradiated and obstructed submaxillary salivary glands simulating cervical lymph node metastasis, John C. Evans and Lauren V. Ackerman, April, 550

SALYER, JOHN M., BLAKE, HU A., and FORSEE, JAMES H.: Pulmonary hematoma (ab), Feb., 285

SALZMAN, EMANUEL, REID, JOHN H., and OGURA, GEORGE I.: Cavernous metastatic pulmonary carcinoma. A report of two cases (ab), April, 608

—See PECK, MORDANT E.

SAMPSON, D. ALAN: Wide-angle trifocal eyeglasses for radiologists, Feb., 255

SANDERSON, STEVENS S. See ACETO, JOSEPH N.

SANDS, W. WAYNE: Survey roentgenograms as an aid in the diagnosis of acute abdominal conditions (ab), May, 773

SANDSTRÖM, CARL: Contrast media for the kidneys, heart and vessels, and their toxicity (ab), Feb., 303

SANQUIRICO, GIOVANNI, and MINUTO, NICOLO': More on the early diagnosis of cancer of the stomach (ab), April, 617

SANTY, PAUL, GALT, PIERRE, and TOURAINE, ROGER: Bronchial and pulmonary hamartochondromas (ab), Feb., 286

SAPRIZA, JOSÉ. See RIMINI, RICARDO

SARCOIDOSIS

—contribution to Besnier-Boeck-Schaumann disease (ab), K. Werner, June, 897

—nephrocalcinosis associated with sarcoidosis: presentation and discussion of 7 cases, Charles N. Davidson, John M. Dennis, Eugene R. McNinch, James K. V. Willson and Webster H. Brown, Feb., 203

—pulmonary fibrosis and cor pulmonale in sarcoidosis, James J. McCort and Peter J. Pare, April, 496

SARCOMA

—angiosarcoma

—treatment by irradiation of lymphangiosarcoma in post-mastectomy lymphedema; case (ab), Arnold J. Rawson and Joe L. Frank, Jr., Feb., 308

Ewing's. See Tumors, experimental

Kaposi's

—x-ray findings in Kaposi's angiomatosis (sarcoma idiopathicum hemorrhagicum multiplex), (ab), G. Bonse and R. Karg, Feb., 307

myosarcoma

—leiomyosarcoma of duodenum; case; summary of literature (ab), Mandel Weinstein and Morton Roberts, Jan., 138

—massive leiomyosarcomas of stomach; 5 cases (ab), George Crile, Jr., and L. K. Groves, May, 775

osteogenic. See Bones, tumors

reticulosarcoma

—roentgen study of primary retothelial sarcoma of stomach; 2 cases (ab), C. H. Grasser, June, 901

SARNAT, BERNARD G., BRODIE, ALLAN G., and KUBACKI, W. HOWARD: Fourteen-year report of facial growth in case of complete anodontia with ectodermal dysplasia (ab), May, 767

SAUVAGE, M. See LOISELEUR, J.

SAWYERS, THOMAS M., and ROSENFELD DAVID D.: Appendiceal stones simulating ureteral calculi (ab), June, 903

SBERNINI, CLAUDIO, and ORLANDINI, IVO: Effect of roentgen irradiation on the laryngotracheal lymph vessels (ab), March, 476

SCANLON, EDWARD. See DAVIS, CARL, Jr.

SCAPHOID BONE CARPAL

—fracture of carpal navicular bone: end-result study in military personnel (ab), Joseph S. Barr et al, May, 784

SCAPHOID BONE, TARSAL

—naviculo-cuneiform fusion in treatment of flat foot (ab), Ewen A. Jack, Jan., 145

SCHACH, ROBERT P.: Translumbar arteriography. A survey of its uses (ab), Jan., 150

SCHAEDE, A., and THURN, P.: The size of the heart chambers determined by cardiac catheterization (ab), May, 771

SCHALIMTZEK, M. See HASNER, E.

SCHALL, LEROY A., MACMILLAN, ALEXANDER S., and ST. AUBIN, PAUL M. G.: The laminogram as an aid in the diagnosis of diseases of the larynx (ab), April, 606

SCHALTENBRAND, G.: Orthoroentgenography (ab), May, 789

SCHIEL, AXEL, and MYHRE, EIVIND: Malignant lymphomata. A review of the pathology, clinic features and therapy (ab), May, 792

SCHETLIN, CHARLES F. See WEST, JOHN P.

SCHILLING, FREDERICK J. See WEST, JOHN P.

SCHINDLER, RUDOLF. See SILK, ARTHUR D.

SCHINZ, H. R. See EPPRECHT, W.

SCHLESINGER, MONROE J. See WESSLER, STANFORD

SCHLESINGER, PAUL. See BENCHIMOL, AARON B.

SCHLEUSSNER ROENTGEN PRIZE (sixth), April, 596

SCHLOSSER, J. V. See SNAVELY, J. E.

SCHLUMBERGER, HANS G., and BURK, DONALD H.: Comparative study of the reaction to injury. II. Hypervitaminosis D in the frog with special reference to the lime sacs (ab), June, 906

SCHMID, PAUL CH.: Technic of bronchography in children (ab), Feb., 284

SCHNECKLOTH, ROLAND E. See KURLAND, GEORGE S.

SCHNEIDER, BENJAMIN. See STERNE, EUGENE H., Jr.

SCHNEIDER, BERTRAM A. See LAAGE, HERBERT

SCHNEIDER, MARTIN, WYBORN, ROBERT C., BILHAMMER, ROBERT, and FINERTY, JOHN C.: Protection of irradiated rats by parabiosis with adrenalectomized or splenectomized partners, Feb., 234

SCHNEIDRIZK, W. E. J.: Intrathoracic irradiation of the hilum after resection for bronchial carcinoma. A preliminary report (ab), Jan., 151

SCHOEN, DETLEV: Selective arteriography (ab), March, 465

The torn Achilles tendon in the roentgenogram (ab), March, 462

SCHRAER, HARALD. See GERSHON-COHEN, J.

SCHUBERT, GERHARD: Radio-resistance and development of resistance of malignant tumors (ab), Jan., 153

SCHUCK, MILLER H. See AMES, WENDELL R.

SCHÜLLER-CHRISTIAN SYNDROME

—histiocytosis X. Integration of eosinophilic granuloma of bone, "Letterer-Siwe disease," and "Schüller-Christian disease" as related manifestations of single nosologic entity (ab), Louis Lichtenstein, May, 782

SCHULER, B. See HAUBRICH, R.

SCHULZ, MILFORD D. See WANG, C. C.

SCHUMANN, E.: Roentgen examination for the differentiation of simple hypospadias from hypospadias associated with hermaphroditism (ab), March, 464

SCHWARTZ, HENRY G. See SEAMAN, WILLIAM B.

SCHWARTZ, JEROME, and NARDIELLO, VINCENT: Furacin vaginal suppositories: their use with radiation therapy for malignant pelvic neoplasms (ab), March, 471

SCHWARTZ, GERHART S., and ISLAM, A. E.: The use of conventional depth-dose tables in divided-port x-ray therapy. Transmarginal radiation and depth-dose distribution, May, 733

SCIARRA, DANIEL, and SPROFKEIN, BERTRAM E.: Symptoms and signs referable to the basal ganglia in brain tumor (ab), Feb., 281

SCIENTIFIC PAPERS

—so you are going to present a scientific paper (ed), Robert P. Barden, June, 875

SCINTIGRAMS. See Radioactivity

SCINTILLATION COUNTER. See Counters

SCINTISCANNER. See Thyroid, cancer

SCLERA

—focal scleral necrosis: a late sequel of irradiation (ab), Ira S. Jones and A. B. Reese, April, 639

SCLERODERMA

—discussion (ab), Edward R. Cullinan et al, May, 790

—pulmonary manifestations (ab), Wade H. Shuford et al, May, 771

SCLEROSIS

multiple

—ventricular displacement and electroencephalographic focus in multiple sclerosis (ab), P. A. Lindstrom, May, 764

tuberosa

—roentgenologic findings: bone manifestations (ab), Harry I. Berland, April, 624

SCOFIELD, N. E. See LOW-BEER, B. V. A.

SCOLIOSIS. See Spine, curvature

SCOTT, MICHAEL. See LIN, PAUL

SCOTT, R. KATE, HOLMAN, W. P., and FINCKH, E. S.: X-ray irradiation and conservative surgery in the treatment of chronic duodenal ulcer (ab), May, 776

SCOTT, ROLAND B. See JENKINS, MELVIN E.

SCUDDER, JOHN. See RUGH, ROBERTS

SEAMAN, WILLIAM B., MARDER, SUMNER N., and ROSENBAUM, HERBERT E.: The myelographic appearance of adhesive spinal arachnoiditis (ab), Jan., 145

—See MARDER, SUMNER N.

—See SHUFORD WADE H.

—See TER-POGOSSIAN, MICHEL M., and SCHWARTZ, HENRY G.: Localization of intracranial neoplasms with radioactive isotopes, Jan., 30

- SEEDORF, E. E., POWELL, W. N., GREENLEE, R. G., and DYSART, D. N.:** Telepaque and pseudoalbuminuria (ab), June, 905
- SEEMANN, H. E., and SPLETTSTOSSER, H. R.:** Some physical characteristics of Potter-Bucky diaphragms, April, 575
- SELDINGER, SVEN I.:** Catheter replacement of the needle in percutaneous arteriography. A new technique (ab), March, 466
- SELLA TURCICA**
—report on radiographic measurements of normal sella turcica in Filipinos (ab), P. J. Garcia and A. M. Laxamana, June, 893
- SEMINAL VESICLES**
—roentgen interpretation of vesiculograms (ab), Athayde Pereira, March, 464
- SENNETT, EDWARD J.:** Chordoma: its roentgen diagnostic aspects and its response to roentgen therapy (ab), Feb., 299
- SENNOTT, WALDRON M., and WORRELL, HOWARD E.:** Multifilm cassette for use in laminagraphy (ab), May, 789
- SERUTAN**
—esophageal obstruction due to Serutan (ab), A. Melamed and A. Marck, March, 451
- SEYSS, R.:** Functional roentgenology of the urinary tract (ab), June, 909
- SHAIKEN, JOSEPH:** Diagnosis and management of esophageal hiatus hernia (ab), Jan., 139
- SHALEK, R. J. See COLE, A.**
- SHANDS, A. R., Jr. See DUNLAP, KNOX**
- SHAPIRO, IRVING J. See LEVIN, BERTRAM**
- SHAPIRO, ROBERT:** Cholecystography; a critical review, Feb., 245
- SHEARS, B. H.:** The helicoid uterus (ab), Feb., 301
- SHELDON, P. W. E., WICKBOM, INGMAR, and PENNY-BACKER, J. B.:** Pneumo-encephalography, with special reference to the demonstration of the basal cisterns (ab), Feb., 281
- See **WICKBOM, INGMAR**
- SHERMAN, LLOYD F., and TENNER, ROBERT J.:** Melanin spots of the lips, oral mucosa and digits associated with intestinal polyposis. Report of a case (ab), Jan., 139
- SHIELDS, W. E., ADAMSON, N. E., Jr., and MacGREGOR, J. B.:** Peptic ulcer perforation following administration of Phenylbutazone (ab), March, 454
- SHOCK**
—shock, toxemia in radiation lethality (ab), Roberts Rugh et al, June, 922
- SHOOP, LUCILLE. See BAUER, FRANZ K.**
- SHORE, SAMUEL, JACOB, HARRY H., and CANNON, JACK A.:** Intestinal obstruction resulting from biliary calculi (gallstone ileus) (ab), Jan., 138
- SHOULDER**
—common injuries of musculotendinous cuff of shoulder (ab), Julius S. Neviaser, Feb., 299
- diagnosis of shoulder lesions due to injuries of rotator cuff (ab), V. H. Ellis, Jan., 144
- lesions producing bursitis-like symptoms: importance of radiographic study before treatment of bursitis (ab), John D. Osmond, Jr., Feb., 299
- SHUFORD, WADE H., SEAMAN, WILLIAM B., and GOLDMAN, ALFRED:** Pulmonary manifestations of scleroderma (ab), May, 771
- SIGMOID**
volvulus. See Intestines
- SILER, EUGENE T. See ALLEN, MAX S.**
- SILICOSIS. See Pneumoconiosis**
- SILK, ARTHUR D., BLOMQUIST, OLOV A., and SCHINDLER RUDOLF:** Ulcer of the greater gastric curvature (ab), March, 453
- SILVER, C. P. See CUMMINS, CHRISTOPHER**
- SILVERMAN, FREDERIC N.:** Calcification of the intervertebral disks in childhood, June, 801
- Roentgen manifestations of unrecognized skeletal trauma in infants (ab), March, 456
- SILVERMAN, JACOB J., TALBOT, THEODORE J., and McCLEAN, ROBERT W.:** Mediastinal emphysema following tonsillectomy (ab), Feb., 287
- SIMON, G.:** Tuberculous bronchitis and bronchiectasis (ab), May, 768
- and **du BOULAY, GEORGE:** Value of radiology in assessing the progress of duodenal ulceration under treatment (ab), June, 902
- SIMONS, CHARLES S. See RUST, JOHN H.**
- SINGISER, JAMES A. See PRATHER, GEORGE C.**
- SINGLETON, EDWARD B., and HOLT, JOHN F.:** Myositis ossificans progressiva, Jan., 47
- SINUSES, PARANASAL**
See also Maxillary Sinus; Sphenoid Sinus
—Kartagener's triad; 2 cases, T. A. Gross, March, 347
- SJÖGREN, S. E.:** Experiences in localisation of brain tumours by means of diiodo¹³¹ fluorescein (ab), June, 891
- Percutaneous vertebral angiography. A review of 250 cases (ab), June, 889
- and **FREDZELL, GEORGE:** Apparatus for serial angiography (ab), June, 893
- SKANSE, BENGT. See JOHANSSON, SVEN A. E.**
- SKARICA, P. See KÖRBLER, J.**
- SKIN**
—effect of Priscoline on clearance of radiosodium from muscle and skin of man in normal and diseased limbs (ab), Jack Freund et al, May, 796
- generalized hyperostosis and pachyderma (ab), Zdeněk Mafatka and Adolf Štředa, March, 457
- local enzymatic treatment of radiation necrosis of skin (ab), Sven Hultberg, Feb., 320
- CANCER**
—radium treatment of cutaneous and lip cancer (ab), J. Körbler et al, March, 467
- radiodermatitis. See Radioactivity**
- tumors**
—autoradiography of mast cells in experimental tumors of mice injected with radioactive sulfur (³⁵S) (ab), G. Asboe-Hansen, May, 795
- SKLAROFF, DAVID M. See GERSHON-COHEN, J.**
- See **ORLOFF, T. L.**
- SKOKAN, ZDENĚK V.:** Thoracic sympathicoblastoma simulating an intrapulmonary tumor (ab), March, 446
- SKORNECK, ALAN B.:** Pseudodiverticular sarcoma of the stomach (ab), Feb., 291
- SKOW, R. K., VANDIVERT, V. V., and HOLDEN, F. R.:** Hazard evaluation and control after a spill of 40 mg. of radium (ab), June, 921
- SKULL. See Cranium**
- SLATTERY, R. V.:** Heart disease discovered on chest microfilms (ab), May, 772
- SLOAN, HERBERT:** Lobar obstructive emphysema in infancy treated by lobectomy (ab), April, 607
- SLOAN, ROBERT D. See BAHNSON, HENRY T.**
- SMITH, A. G. See TEXTER, E. C., Jr.**
- SMITH, CHARLES D., and WEAVER, EDGAR N.:** Lipoma of the corpus callosum. Case report (ab), Feb., 282
- SMITH, DONALD R., STEINBACH, HOWARD L., LYON, RICHARDS P., and STRATTE, PAUL B.:** Extraperitoneal pneumography (ab), Jan., 148
- SMITH, FALCONER. See SMITH, WILLIE W.**
- SMITH, FREDERICK M. See GASTON, SAWNIE R.**
- SMITH, HORACE D. See COLVIN, E. M.**
- SMITH, JAMES K. See JACOBS, LEWIS G.**
- SMITH, MARCUS J.:** Roentgenographic aspects of complete and incomplete pulmonary infarction (ab), March, 445
- SMITH, PARKE G.:** A résumé of the experience in the making of 1,500 renal angiograms (ab), June, 910
- SMITH, WILLIE W., SMITH, FALCONER, RUTH, H. JEANETTE, CANTER, HARRY Y., and GRENNAN, MARIE M.:** Prophylactic antibiotic therapy in x-irradiated animals (ab), Jan., 160
- See **GONSHERY, LEON**
- See **MARSTON, ROBERT O.**
- SMITHERS, D. W.:** Facts and fancies about cancer of the lung (ab), April, 633
- See **LAYNE, D. A.**
- SMULEWICZ, J.:** A case of moniliasis of the lungs (ab), May, 770
- SNARELY, J. R., BULLINGTON, R. H., and SCHLOSSER, J. V.:** Effect of therapeutic irradiation of carcinoma of cervix on liver function (ab), May, 797
- SNORRASON, E. See HASNER, E.**
- SNOW, LEO B. See STAUFFER, HERBERT M.**
- SOCIETY OF NUCLEAR MEDICINE, May, 754**
- SODIUM**
—in vitro studies of aspects of metabolism of sodium by human erythrocytes using sodium (ab), William D. Love and George E. Burch, Jan., 158
- radioactive. See Placenta; Radioactivity
- SOFT TISSUE**
—soft tissue calcifications in cord lesions (ab), Miriam Liberson, April, 625
- SOFT TISSUE ROENTGENOGRAPHY. See Placenta**
- SOLIS-COHEN, LEON. See FRIEDMAN, PAUL S.**
- SONNE, IRVIN H., Jr. See LOVE, JESSHILL**
- SOSMAN, MERRILL C. See JARVIS, J. LUTHER**
- SOUCHERAY, PHILIP H., and O'LOUGHLIN, BERNARD J.:** Cavitation within bland pulmonary infarcts (ab), June, 897
- SOULE, A. BRADLEY, Jr. See FOLEY, JOSEPH C.**
- SOULE, S. D.:** Radioactive colloidal gold in carcinoma of the cervix (ab), April, 637
- SPECHT, NORMAN W., BAUER, FRANZ K., and ADAMS, RALPH M.:** Thyroid carcinoma. Visualization of a distant osseous metastasis by scintiscanner; observations during I¹³¹ therapy (ab), April, 636
- SPENCER, R.:** Intestinal obstruction in the newborn associated with faulty development of the midgut and its mesentery. A description of three cases (ab), Jan., 138
- SPHENOID BONE**
—meningiomas of anterior clinoid process as cause of unilateral loss of vision: surgical considerations (ab), Alfred Uihlein and Robert D. Weyand, Jan., 124
- SPHENOID SINUS**
—osteitis (ab), Lewis L. Haas, Feb., 283
- SPINAL CANAL ROENTGENOGRAPHY**
See also Spine, intervertebral disks
—myelographic appearance of adhesive spinal arachnoiditis (ab), William B. Seaman et al, Jan., 145
- myelographic demonstration of cysts of spinal membranes, Lewis G. Jacobs, James K. Smith and Philip S. Van Horn, Feb., 215
- myelography in spinal metastases, Saul Heiser and Alfred J. Swyer, May, 695
- SPINAL CORD**
—cerebellar medulloblastoma: treatment by irradiation of whole central nervous system (ab), Edith Paterson and R. F. Farr, Feb., 307

SPINAL CORD—cont.

- lumbar and sacral cysts of meningeal origin, Kenneth J. Strully and Saul Heiser, April, 544
- mechanism and treatment of spinal cord disorders associated with cervical spondylosis (ab), A. R. Taylor, Feb., 297
- soft tissue calcifications in cord lesions (ab), Miriam Liberson, April, 625
- treatment of meningeal system by means of radioactive colloidal gold and x-rays (ab), Charles L. Lewis, June, 914
- tumors**
 - diagnosis of spinal tumors by means of gas myelography (ab), Sven Odén, June, 911
 - spinal meningiomas and neurofibromas (ab), J. W. D. Bull, June, 912

SPINAL PUNCTURE

- spinal complications following lumbar puncture: review of literature and report of 4 cases (ab), S. Frank Redo, March, 461

SPINE

- See also Atlas and Axis; Sacrum
- abnormalities**
 - roentgen diagnosis of rare malformations of cervical spine (ab), C. Buetti, March, 460
- ankylosis**
 - ankylosing spondylitis (ab), F. Dudley Hart, June, 905
 - mechanism and treatment of spinal cord disorders associated with cervical spondylosis (ab), A. R. Taylor, Feb., 297
- arthritis**
 - spondylitis hyperostotica (ab), V. R. Ott, June, 905
- curvature**
 - esophageal ulcer with severe kyphoscoliosis (ab), R. Haubrich, Feb., 291
- diseases**
 - benign form of acute osteitis in young children (ab), A. E. Bremner and G. A. Neligan, Feb., 297
 - blastomycosis and actinomycosis (ab), George J. Baylin and John M. Wear, March, 461
- fractures**
 - vertical fracture of cervical vertebral bodies, Samuel Richman and Robert L. Friedman, April, 536
- intervertebral disks**
 - calcification of disks in childhood, Frederic N. Silverman, June, 801
 - concerning 80 disk opacifications: interest and indications of discography (ab), R. De Haene, March, 462
 - degeneration of cervical disks following whip-lash injury (ab), Abraham Myers, Feb., 297
 - diagnostic lumbar disk puncture: clinical review and analysis of 67 cases (ab), L. Walk, Jan., 142
 - diagnostic problems in herniated disk (ab), Raphael R. Goldenberg, Feb., 296
 - discography (ab), Raymond De Haene, Jan., 144
 - discography in diagnosis of herniation of lower lumbar disks (ab), John J. Davies and E. Converse Peirce, II, June, 907
 - dissolution of disk in aged normal: the phantom nucleus pulposus, J. Gershon-Cohen, Harald Schraer, David M. Sklaroff and Nathan Blumberg, March, 383
- osteomyelitis**
 - following prostatic surgery, Edward De Feo, March, 396
- spinal complications following lumbar puncture: review of literature and report of 4 cases (ab), S. Frank Redo, March, 461**
- roentgenography**. See also Spinal Canal Roentgenography; other subheads under Spine
 - lumbosacral junction: roentgenographic comparison of patients with and without backaches (ab), Clarence A. Splithoff, May, 783
 - lumbosacral transitional vertebrae: clinical and roentgenologic study of 400 cases of low back pain (ab), E. Hasner et al., Jan., 141
 - motion of lumbar spine: roentgenologic study (ab), Stanley S. Tanz, March, 460
 - principles of vertebral tomography (ab), Ingemar Bokström, Jan., 142
 - qualitative comparison between standard type of examination and tomography for certain intraosseous structural changes (ab), Folke Knutsson, Jan., 143
- tumors**
 - chordoma: its roentgen diagnostic aspects and its response to roentgen therapy (ab), Edward J. Sennett, Feb., 299
 - chordoma of lumbar vertebra (ab), Harvey W. Baker and Bradley L. Coley, Feb., 298
 - giant-cell tumor: 2 cases (ab), W. R. Hamsa and L. S. Campbell, Feb., 298
 - myelography in spinal metastases, Saul Heiser and Alfred J. Swyer, May, 695
 - rare manifestation of vertebral angioma (ab), Sergio Chiappa and Adolfo Sacchi, Feb., 298
- wounds and injuries**
 - degeneration of cervical intervertebral disks following whip-lash injury (ab), Abraham Myers, Feb., 297

SPLEEN

- bone marrow changes in patients with chronic leukemia treated by splenic x-irradiation: preliminary report (ab), F. W. Gunz, June, 921
- evaluation of radiologic visualization of spleno-portal vein (spleno-portography) (ab), A. Cacciari and A. Frassinetti, April, 630
- portal phlebography by transperitoneal parenchymatous splenic injection (ab), L. Leger et al, March, 466

- protection of irradiated rats by parabiosis with adrenalectomized or splenectomized partners, Martin Schneider, Robert C. Wybourn, Robert Binhammer and John C. Finerty, Feb., 234
- splenic cysts with report of case of large unilocular cyst of rapid growth (ab), Richard P. Bell, Jr., April, 623
- splenic-portal venography: technic utilizing percutaneous injection of radiopaque material into spleen (ab) Henry T. Bahnson et al, Feb., 306
- SPLETTSTOSSER, H. R.** See **SEEMANN, H. E.**
- SPLITHOFF, CLARENCE A.**: Lumbosacral junction: roentgenographic comparison of patients with and without backaches (ab), May, 783
- SPONDYLITIS**. See **Spine**
- SPONDYLOSIS**. See **Spine**
- SPROFKIN, BERTRAM E.** See **SCIARRA, DANIEL**
- SPRUE**. See **Celiac Disease**
- SRIVASTAVA, S. P.**: Carcinoma of the oral cavity and the lower jaw (ab), May, 791
- STAUFFER, HERBERT M., SNOW, LEO B., and ADAMS, ANDREW B.**: Roentgenologic recognition of habenuar calcification as distinct from calcification in the pineal body. Its application in cerebral localization (ab), May, 765
- STEEN, LOWELL H., and NEWELL, W. G.**: Calcified gastric leiomyoma. Case report (ab), March, 453
- STEENKEN, WILLIAM, JR., WOLINSKY, EMANUEL, BRISTOL, LEONARD J., and COSTIGAN, WILLIAM J.**: Use of the rabbit in experimental tuberculosis. I. A visual method of evaluation of antituberculous agents by serial chest roentgenograms (ab), April, 611
- STEIN, FELIX, BLOCH, HARRY, and KENIN, ABEL**: Non-traumatic subluxation of the atlanto-axial articulation. Report of a case (ab), March, 461
- STEIN, HANS F.**: Coexisting pulmonary coccidioidomycosis and tuberculosis (ab), Feb., 285
- STEINBACH, HOWARD L., and BROWN, REYNOLD F.**: Retroperitoneal tumors in children. Roentgen diagnosis (ab), Feb., 305
- CRANE, JACKSON T., and BRUYN, HENRY B.**: The roentgen demonstration of cirrhosis of the liver with fatty metamorphosis. Report of a case due to congenital fibrocystic disease, June, 838
- KOLB, FELIX O., and GILFILLAN, RUTHERFORD**: A mechanism of the production of pseudofractures in osteomalacia (Milkman's syndrome), March, 388
- See **SMITH, DONALD R.**
- STEINBERG, ISRAEL, DOTTER, CHARLES T., and LUKAS, DANIEL S.**: Congenital absence of a main branch of the pulmonary artery (ab), April, 615
- See **HONIG, EDWARD I.**
- See **LUKAS, DANIEL S.**
- STENDER, H. ST.** See **HORNKYIEWYTSCH, TH.**
- STENSTRÖM, K. WILHELM.** See **NICE, CHARLES M.**
- STEPHENS, H. BRODIE.** See **BINKLEY, FREDERICK M.**
- STEPHENS-NEWSHAM, L. G.**: Measurement of radioactive iodine in vivo (ab), April, 635
- See **BAXTER, HAMILTON**
- STERNE, EUGENE H., Jr., and SCHNEIDER, BENJAMIN**: Psoriatic arthritis (ab), Jan., 140
- STERNUM**
 - radiologic appearances of heart, esophagus, and lungs in funnel chest deformity (ab), Nils P. G. Edling, Feb., 288
- STEROIDS**. See **Androgens**
- STEVENSON, CLYDE A., and WILSON, McCLEURE**: Double contrast manifestations of nonpolypoid colon diseases (ab), April, 621
- STIRRETT, LLOYD A., and BEAL, JOHN M.**: Carcinoma of the stomach following gastroenterostomy for duodenal ulcer (ab), April, 618
- YUHL, ERIC T., and LIBBY, RAYMOND L.**: A new technique for the diagnosis of carcinoma metastatic to the liver. Preliminary report (ab), Jan., 139
- See **YUHL, ERIC T.**
- STÖSSEL, H. U.**: Clinical significance of pharmacoradiography, particularly of morphine, in diseases of the stomach and duodenum (ab), June, 901
- See **HUBER, K.**
- STOKINGER, HERBERT E.**: Size of dose: its effect on distribution in the body (ab), Feb., 313
- STOMACH**
 - effect of intragastric irradiation on gastric acidity in dog (ab), Benum W. Fox et al, May, 797
 - experimental study of gastric wall thickness at site of peristalsis in dogs, Arthur W. Pryde and Eugene P. Pendergrass, April, 559
 - gastric block: a disturbance in gastric motive function (ab), Bengt Lilja, March, 452
 - gastro-esophageal incompetence in children, with special reference to minor degrees of partial thoracic stomach, Roy Astley and Ivo J. Carré, March, 351
 - gastro-esophageal regurgitation: its incidence and relation to symptoms (ab), L. Werbeloff and C. Merskey, June, 900
 - permanent deposition of iodine contrast medium in wall of stomach (ab), Albert Bogsch, Jan., 137
 - torsion (ab), Milan Svoboda, March, 452
 - use of gastric distention as aid to pediatric urography (ab), David H. Allen, April, 628
- abnormalities**
 - upside-down stomach in paraesophageal hernia (ab), Richard Flynn, April, 619

STOMACH—cont.

- cancer**
 —carcinoma following gastroenterostomy for duodenal ulcer (ab), Lloyd A. Stirrett and John M. Beal, April, 618
 —carcinoma: necessity for re-evaluation of therapeutic philosophy (ab), A. Ochsner and J. Blalock, Feb., 291
 —coexistent carcinoma of stomach and hypertrophic gastritis; case, with review of literature (ab), E. C. Texter, Jr., et al, May, 775
 —gastric ulcer and gastric cancer (ab), I. S. Ravdin and Robert C. Horn, Jr., April, 618
 —giant rugae with normal overlying mucosa simulating neoplasm; case (ab), Daniel Marshall, Feb., 292
 —more on early diagnosis (ab), Giovanni Sanquirico and Nicolo' Minuto, April, 617
 —relation of gastric ulcer to carcinoma of stomach (ab), Samuel F. Marshall, April, 618
 —roentgen examination, with special consideration of diagnosis of cancer (ab), A. Zuppinger and S. Läser, June, 901
cardiospasm
 —diagnosis (ab), Arthur M. Olsen et al, March, 451
diseases
 —clinical significance of pharmacoradiography, particularly of morphine, in diseases of stomach and duodenum (ab), H. U. Stössel, June, 901
 —Crohn's disease involving stomach; 2 cases (ab), F. R. R. Martin and R. J. Carr, Jan., 136
diverticula
 —gastric diverticula (ab), K. E. Matzinger, March, 452
 —pseudodiverticular sarcoma of stomach (ab), Alan B. Skorneck, Feb., 291
inflammation
 —coexistent carcinoma of stomach and hypertrophic gastritis; case, with review of literature (ab), E. C. Texter, Jr., et al, May, 775
 —stenosis of stomach caused by corrosive gastritis (following ingestion of hydrochloric acid) (ab), Alberto L. C. Maggi and M. Meeroff, May, 775
motility
 —gastric emptying time: comparative studies with placebos, Prantal and Banthine (ab), G. Kenneth Hawkins et al, April, 617
mucosa
 —benign prolapse; clinical, roentgenologic, and gastroscopic study (ab), Jacob Lichstein and Leonard M. Asher, Jan., 137
 —duodenal herniation of mucosa (ab), F. Granone, Feb., 293
 —giant rugae with normal overlying mucosa simulating gastric neoplasm; case (ab), Daniel Marshall, Feb., 292
 —Meckel's diverticulum with intussusception, ulceration with hemorrhage, and ectopic gastric mucosa and pancreatic tissue (ab), Michael F. Koszalka, April, 621
 —prolapse; summary of 150 cases (ab), Abraham Melamed et al, Feb., 292
 —pyloric obstruction due to mucosal diaphragm (ab), Alexander N. Rota, Jan., 137
 —transpyloric prolapse (ab), W. P. Kleitsch and R. L. Lawton, Jan., 138
 —understanding of prolapsed mucosa (ab), Francis W. Wilson, Jan., 138
roentgenography
 —cholecystectomy and its relation to stomach and duodenum; review of 75 cases with preoperative and postoperative x-ray studies (ab), Robert E. Rothenberg, Feb., 294
 —pneumostratigraphic study (ab), Mario Mondello and Armando Barone, April, 616
 —with tetraethylammoniumbromide (TEAB): a new pharmacodynamic procedure (ab), M. Fóti, March, 452
stenosis. See Stomach, inflammation
surgery
 —disorders of motility of small bowel (following gastrectomy) (ab), Ian W. MacPhee, Feb., 293
 —obstruction of proximal jejunum following gastric resection and antecolic anastomosis; 3 cases (ab), John P. West, May, 777
 —post-gastrectomy stomach remnant (ab), C. N. Pulvertaft, May, 777
tumors
 —benign tumors (ab), Ralph Colp and Vernon A. Weinstein, Feb., 292
 —calcified leiomyoma; case (ab), Lowell H. Steen and W. G. Newell, March, 453
 —intramural extramucosal tumors (ab), R. Brian Holmes, April, 617
 —malignant lymphoma, I. R. Berger, Brit B. Gay, Jr., and C. M. Whorton, April, 527
 —massive leiomyosarcomas; 5 cases (ab), George Crile, Jr., and L. K. Groves, May, 775
 —myoma; review of 50 cases (ab), T. Antonie, March, 453
 —pneumoperitoneum in radiologic diagnosis of cardiac and paracardial tumors (ab), Carlo Menghini and Renato de Marchi, Jan., 136
 —pseudodiverticular sarcoma (ab), Alan B. Skorneck, Feb., 291
 —roentgen study of primary retothel sarcoma; 2 cases (ab), C. H. Grasser, June, 901
ulcers. See Peptic Ulcer
volvulus
 —(ab), John P. West and Vann T. Floyd, May, 774
STONER, RICHARD D. See HALE, WILLIAM M.
STONHAM, FRANKLYN: Osteoarthritis of the hip joint (ab), April, 623

- STORAASLI, J. P., BONTE, F. J., KING, D. P., and FRIEDEL, H. L.:** Use of radioactive colloidal gold in the treatment of serous effusions of neoplastic origin (ab) April, 637
STORER, J. B. See LUSHBAUGH, C. C.
STOREY, CLIFFORD F., GRANT, ROALD A., and ROTHMAN, BRUCE F.: Coin lesions of the lung (ab), May, 769
STOUT, A. P. See TOTTEN, R. S.
STOWELL, R. E. See WILSON, M. E.
STRATEMEIER, E. H., and BARRY, J. W.: Torsion of the lung following thoracic trauma. A case report, May, 726
STRATIGRAPHY. See Body Section Roentgenography
STRATTE, PAUL B. See SMITH, DONALD R.
STREDA, ADOLF. See MARATKA, ZDENĚK
STREIT, HAROLD A. See DUNLAP, KNOX
STREPTODORNASE AND STREPTOKINASE
 —local enzymatic treatment of radiation necroses of skin (ab), Sven Hultberg, Feb., 320
STREPTOMYCIN
 —experimental infection and streptomycin treatment in irradiated mice (ab), Robert Q. Marston et al, Jan., 161
 —intracranial calcification as late result of tuberculous meningitis following treatment by streptomycin (ab), R. Garsche, Feb., 282
 —naturally occurring infections in untreated and streptomycin-treated x-irradiated mice (ab), Leon Gonsheer et al, Jan., 160
 —prophylactic antibiotic therapy in x-irradiated animals (ab), Willie W. Smith et al, Jan., 160
 —reduction of mortality in swine from combined total-body radiation and thermal burns by streptomycin (ab), Hamilton Baxter et al, April, 640
STRODE, ERNEST C., and VANCE, CHARLES A.: Herniation of the right diaphragm secondary to trauma (ab), March, 450
STRONTIUM, RADIOACTIVE. See Radioactivity
STRULLY, KENNETH J., and HEISER, SAUL: Lumbar and sacral cysts of meningeal origin, April, 544
STUDDERT, T. C.: Farmer's lung (ab), April, 610
STUPPY, LAURENCE J. See JAFFE, HENRY L.
SUESS, JOSEPHINE. See RUGH, ROBERTS
SULFUR, RADIOACTIVE. See Radioactivity
SUPPOSITORIES. See Furacin
SUPRACONDYLOID PROCESS. See Humerus
SURGERY
 —discussion on use of radioisotopes in surgery (ab), E. E. Pochin et al, Feb., 311
 —postoperative complications. See Intestines, obstruction; Osteomyelitis; Pubic Bone; etc.
SURRACO, GERMÁN H. See RIMINI, RICARDO
SUTER, F. See RÜTTIMANN, A.
SUTTON, DAVID: Radiologic aspects of pontine gliomata (ab), June, 892
SVOBODA, MILAN: Bronchography with Joduron B (ab), March, 444
 —Torsion of the stomach (ab), March, 452
SWISHER, SCOTT N. See FURTH, FRANK W.
SWYER, ALFRED J. See HEISER, SAUL
SYMPATHECTOMY
 —in chronic occlusive arterial disease (ab), W. Graham Knox and Herbert Parsons, March, 466
SYMPATHICOBLASTOMA. See Tumors, sympathoblastoma
SYMPHYSIS PUBIS. See Pelvis, measurement
SYMPOSIUM NEURORADIOLOGICUM, April, 596
SYPHILIS. See Bones; Lungs
SYRINGE
 —syringe shield used in injecting radioactive gold (ab), Paul Getzoff et al, June, 918

T

- TABAH, EDWARD J., and McNEER, GORDON:** Papilloma of the gall bladder with in situ carcinoma (ab), May, 779
TABER, KENNETH W.: A homemade inexpensive manual rapid cassette changer for angiocardiology and cerebral angiography, May, 728
TALAIRACH, J. See FISCHGOLD, H.
TALBOT, THEODORE J. See SILVERMAN, JACOB J.
TANNIN
 —tannin enema in inflammatory conditions of colon (ab), E. Zdansky et al, June, 903
TANZ, STANLEY S.: Motion of the lumbar spine. A roentgenologic study (ab), March, 460
TARSUS. See Foot; Scaphoid Bone, Tarsal
TAUROG, A. See BRIGGS, F. N.
TAYLOR, A. R.: Mechanism and treatment of spinal-cord disorders associated with cervical spondylosis (ab), Feb., 297
TAYLOR, SELWYN. See POCHIN, E. E.
TEACHING
 —American College of Radiology, 21st annual conference of teachers of clinical radiology, Jan., 110
 —Atomic Energy Commission fellowships, Jan., 111
 —course in essential physics of radiotherapy and clinical application of isotopes, University of Southern California, Feb., 273
 —courses on diseases of chest, American College of Chest Physicians, Jan., 111
 —Oak Ridge Institute of Nuclear Studies (basic technique courses), March, 431
TECHNICIANS
 —American Society of X-ray Technicians, April, 596

- TEETH**
—fourteen-year report of facial growth in case of complete anodontia with ectodermal dysplasia (ab), Bernard G. Sarnat et al, May, 767
- TELANGECTASIS**
—pulmonary arteriovenous fistula associated with hereditary hemorrhagic telangiectasis: report of their occurrence in father and son (ab), John R. Tobin, Jr., and Thomas C. Wilder, Feb., 286
- TELEPAQUE**. See Gallbladder, roentgenography
- TEMPORAL BONE**
—osteoclastoma of petrous temporal bone; case benefited by deep x-ray therapy (ab), T. A. R. Dinning, March, 468
- TEMPOROMANDIBULAR JOINT**. See Jaws
- TENDONS**
—torn Achilles tendon in roentgenogram (ab), Detlev Schoen, March, 462
- TENNER, ROBERT J.** See **SHERMAN, LLOYD F.**
- TER-POGOSSIAN, MICHEL M.** See **SEAMAN, WILLIAM R.**
- TERRAMYCIN**
—prophylactic antibiotic therapy in x-irradiated animals (ab), Willie W. Smith et al, Jan., 160
- TESTES**
—effects of fractionated doses of x-radiation on normal and tumor tissue (ab), L. C. Fogg and R. F. Cowing, Feb., 318
—testicular neoplasms; analysis of 113 cases (ab), D. A. Culp, June, 914
- TETANY**. See Parathyroid
- TETRAETHYLAMMONIUMBROMIDE**
—roentgen examination of stomach with tetraethylammonium-bromide (TEAB): a new pharmacodynamic procedure (ab), M. Földi, March, 452
- TETRALOGY OF FALLOT**. See Heart, abnormalities
- TEXTER, E. C., Jr., BAYLIN, GEORGE J., RUFFIN, J. M., and LEGERTON, C. W., Jr.**: Pyloric channel ulcer (ab), May, 776
- LEGERTON, C. W., Jr., REEVES, R. J., SMITH, A. G., and RUFFIN, J. M.**: Coexistent carcinoma of the stomach and hypertrophic gastritis. Report of a case with review of the literature (ab), May, 775
- THIBODEAU, ARTHUR A.** See **BARRE, JOSEPH S.**
- THOMAS, G. T.** See **BESTERMAN, E. M. M.**
- THOMAS, JOHANNES, and FJELDBOERG, NIELS**: Radiation treatment of hemangiomas (ab), May, 791
- THOMAS, SHIRLEY**. See **MACDONALD, COLIN**
- THOMPSON, JOHN J.** See **HAWKINS, G. KENNETH**
- THOMSON, JOHN F., TOURTELLOTTE, WALLACE W., CARTTAR, MAGDALENE S., COX, ROBERT S., Jr., and WILSON, JAMES E.**: Studies on the effects of continuous exposure of animals to gamma radiation from cobalt 60 plane sources (ab), March, 474
- THORAX**
See also Heart; Lungs; Mediastinum; etc.
—radiologic appearances of heart, esophagus, and lungs in funnel chest deformity (ab), Nils P. G. Edling, Feb., 288
—torsion of lung following thoracic trauma; case E. H. Strateimer and J. W. Barry, May, 726
- roentgenography**
—bronchogenic carcinoma in San Diego County: relation of mortality rates to findings in mass chest x-ray survey (ab), A. S. Churchill, Jan., 130
—mortality of persons with photofluorograms suggestive of cardiovascular disease (ab), George W. Comstock, April, 611
—technical modification of routine chest radiographs (ab), Robert W. Currie, April, 610
- tumors**
—intrathoracic fibroma associated with pulmonary hypertrophic osteoarthropathy; unusual case (ab), Otto Deutschberger et al, March, 446
—intrathoracic hibernoma; 3rd reported case (ab), J. Winthrop Peabody, Jr., et al, June, 897
—thoracic sympathicoblastoma simulating an intrapulmonary tumor (ab), Zdeněk V. Skokan, March, 446
- THORBURN, JACK D.** See **BINKLEY, FREDERICK M.**
- THORN, GEORGE W.** See **JARVIS, J. LUTHER**
- THREEFOOT, S. A., BURCH, G. E., and RAY, C. T.**: Chloride "space" and total exchanging chloride in man measured with long life radiolabeled, Cl^{36} (ab), May, 795
- THROMBO-ENDARTERECTOMY**. See **Thrombosis, aortic**
- THROMBOSIS**
aortic
—thrombosis of abdominal aorta treated by thrombo-endarterectomy; case (ab), John P. West et al, May, 787
- cardiac**
—radiologic detection of calcified thrombus within left ventricle; case with surgical verification, J. Stauffer Lehman and Joseph L. Curry, March, 344
- carotid**
—collaterals between external carotid artery and vertebral artery in cases of thrombosis of internal carotid artery (ab), Hs. R. Richter, June, 889
- splenic**
—percutaneous splenic venography (with special reference to thrombosis) (ab), V. Gvozdanović et al, May, 788
- THURN, P.** See **HAUBRICH, R.**
- See **SCHAEDE, A.**
- THYMUS**
—mediastinal tumors of thymic origin (ab), Frederick M. Binkley et al, Feb., 308
- THYROID**
See also Goiter
—evaluation of thyroid panel: practical application of scintillation counter in diagnosis of diseases of thyroid (ab), T. F. Barrett et al, June, 916
—influence of adrenal and gonadal steroids on uptake of iodine by thyroid gland (ab), Walter Zingg and William F. Perry, April, 636
—measurement of radioactive iodine in vivo (ab), L. G. Stephens-Newsham, April, 635
—rate of formation of non-diffusible (organic) fraction of I^{131} in plasma correlated with apparent thyroid state (ab), William E. White, Feb., 314
—serum concentrations of radioiodine in diagnostic tracer studies (ab), Michael C. Barry and Albert E. Pugh, June, 916
- CANCER**
—carcinoma: visualization of distant osseous metastasis by scintiscanner; observations during I^{131} therapy (ab), Norman W. Specht et al, April, 636
—criteria for therapy of malignant lesions with I^{131} (ab), Charles V. Meckstroth and George M. Curtis, May, 794
—iodine-concentrating carcinomas; 3 cases (ab), A. Egmark et al, March, 474
- function**
—functional and histologic effects of therapeutic doses of radioactive iodine on thyroid of man (ab), Brown M. Dobyns et al, March, 473
—measurement of thyroxine synthesis with I^{131} : a test for evaluation of thyroid function in equivocal states (ab), M. E. Morton, Feb., 314
- hyperthyroidism**
—diagnosis of thyrotoxicosis by simple out-patient radioactive iodine technic (ab), Alastair G. Macgregor et al, May, 793
—radioiodine tracer and biopsy in diagnosis and treatment (ab), Carl F. Baumeister, April, 636
—treatment with radioactive iodine, I^{131} (ab), Max S. Allen et al, Jan., 154
—Troell-Juett syndrome (acromegaly complicated by thyroid toxicity and hyperostosis of skull) (ab), Sherwood Moore, April, 606
—use of radioactive iodine in diagnosis and treatment (ab), Robert E. Mack, Feb., 313
- hypothyroidism**
—heart in I^{131} -induced myxedema: comparison of roentgenographic and electrocardiographic findings before and after induction of myxedema (ab), George S. Kurland et al, June, 898
—pericardial effusion associated with myxedema (ab), Paul A. Marks and Betty S. Roof, June, 898
- surgery**. See **Goiter, Exophthalmic**
- THYROIDECTOMY**. See **Goiter, Exophthalmic**
- THYROTOXICOSIS**. See **Thyroid**
- THYROXIN**
—measurement of thyroxine synthesis with I^{131} : a test for evaluation of thyroid function in equivocal states (ab), M. E. Morton, Feb., 314
—metabolism of I^{131} -labeled thyroxine-studies with isolated perfused rat liver (ab), F. N. Briggs et al, Jan., 157
- TICE, GALEN M.**: Treatment of cervical stump carcinoma (ab), Jan., 152
- TIDWELL, ROBERT A.** See **RUSHMER, ROBERT F.**
- TINCKLER, LAURENCE F.**: Presacral perineal pneumography (ab), Feb., 304
- TOBIN, JOHN R., Jr., and WILDER, THOMAS C.**: Pulmonary arteriovenous fistula associated with hereditary hemorrhagic telangiectasis: a report of their occurrence in a father and son (ab), Feb., 286
- TOCHILIN, E., and GOLDEN, R.**: Film measurement of beta-ray depth dose (ab), June, 918
- TOLAN, JOHN H.** See **WEENS, H. STEPHEN**
- TOMOGRAPHY**. See **Body Section Roentgenography**
- TOMPSETT, D. H.** See **LAST, R. J.**
- TONGUE**
—radium in treatment of cancer (ab), Theodore P. Eberhard, March, 469
- TONSILS**
—mediastinal emphysema following tonsillectomy (ab), Jacob J. Silverman et al, Feb., 287
—tonsillar hypertrophy and mediastinal-hilar adenopathy (ab), Carlo Dazzi, Feb., 287
- TOONE, ELAM C., Jr.** See **WILSON, CHARLES W.**
- TORI, G., and PETRUCCI, D.**: Temporary block of a branch of the pulmonary artery for selective angiography (ab), Jan., 150
- TOTTEN, R. S., STOUT, A. P., HUMPHREYS, G. H., II, and MOORE, R. L.**: Benign tumors and cysts of the esophagus (ab), April, 616
- TOURAIN, ROGER**. See **SANTY, PAUL**
- TOURTELLOTTE, WALLACE W.** See **THOMSON, JOHN F.**
- TOXEMIA**
See also **Pregnancy**
—shock, toxemia in radiation lethality (ab), Roberts Rugh et al, June, 922
- TOXOPLASMOSIS**
—clinical and roentgenologic picture of chronic pulmonary toxoplasmosis (ab), H.-J. Gombert, April, 609
- TRACHEA**
—agenesis of lung with vascular compression of tracheobronchial tree (ab), Herbert C. Maier and Wilbur J. Gould, April, 607

TRACHEA—cont.

- effect of roentgen irradiation on laryngotracheal lymph vessels (ab), Claudio Sberini and Ivo Orlandini, March, 476
- tracheopathia osteoplastica; case (ab), William A. Lell, March, 448

TRAUMA

- herniation of right diaphragm secondary to trauma (ab), Ernest C. Strode and Charles A. Vance, March, 450
- osteitis pubis of traumatic etiology (ab), Raymond J. Adams and Fremont A. Chandler, May, 784
- roentgen manifestations of unrecognized skeletal trauma in infants (ab), Frederic N. Silverman, March, 456

TRICHINA

- effect of x-rays on *Trichina* larvae (ab), S. E. Gould et al, Jan., 162

TRICUSPID VALVE

- congenital tricuspid atresia (ab), Roy Astley et al, April, 611

TRIMBLE, HAROLD G.

- Pulmonary "coin" lesions (ab), April, 607

TROELL-JUNET SYNDROME. See Acromegaly**TROWBRIDGE, WILLIAM V.** See ELDRED, EARL**TROXELL, MILLARD A.**

- A histoplasmin and tuberculin study of psychiatric patients having abnormal chest roentgenograms (ab), Jan., 128

TRUNCUS ARTERIOSUS. See Heart, abnormalities**TUBERCULOMA.** See Lungs, tuberculoma**TUBERCULOSIS**

- See also Intestines; Kidneys; Lymph Nodes; Meninges; Tuberculosis, Pulmonary; etc.

experimental

- use of rabbit in experimental tuberculosis. I. A visual method of evaluation of antituberculous agents by serial chest roentgenograms (ab), William Steenken, Jr., et al, April, 611

tuberculin reactions

- histoplasmin and tuberculin study of psychiatric patients having abnormal chest roentgenograms (ab), Millard A. Troxell, Jan., 128

TUBERCULOSIS, PULMONARY

- changes in bronchi in silicosis and silicotuberculosis (ab), G. Worth and W. Heinz, Jan., 128
- coexisting pulmonary coccidioidomycosis and tuberculosis (ab), Hans F. Stein, Feb., 285
- distribution and excretion of radioactive Isoniazid in tuberculous patients (ab), W. R. Barclay et al, Feb., 315
- "initial foci," a special group of minimal tuberculosis. Prognosis and treatment (ab), Erik Hedvall, June, 896

artificial pneumothorax in

- mobile floating fibrin bulla in course of hydropneumothorax (ab), G. Roche, Houspeau and M. Odabachian, Jan., 131

cancer and tuberculosis

- association of tuberculosis and primary bronchogenic cancers (ab), J. Delarue et al, March, 446

mass roentgenologic surveys

- general population roentgenographic surveys: subsequent course of persons considered to have tuberculosis (ab), Wendell R. Ames and Miller H. Schuck, April, 610

roentgenography. See also Tuberculosis, Pulmonary, mass roentgenologic surveys

- phthisiogenic considerations based on tomographic analysis of 320 consecutive cases of localized pulmonary tuberculosis in adults (ab), Hugh Adler, June, 896
- reliability of chest roentgenography and its clinical implications (ab), J. Yerushalmay, June, 896
- routine x-ray examination of chest at antenatal clinic (ab), Audrey Preeth, Jan., 131
- use of rabbit in experimental tuberculosis. I. A visual method of evaluation of antituberculous agents by serial chest roentgenograms (ab), William Steenken, Jr., et al, April, 611

surgical therapy

- evaluation of extrapleural pneumonolysis based on follow-up study of 70 cases with Lucite plombage (ab), Jacob Zimmerman et al, March, 447

TUDWAY, ROBERT C.

- Place of external irradiation in the treatment of osteogenic sarcoma (ab), Jan., 153

Use of radio-active isotopes in an applicator for the treatment of carcinoma of the cervix uteri (ab), March, 472**TULLIS, JOHN L., LAMSON, BALDWIN G., and MADDEN, SIDNEY C.**

- Mortality in swine exposed to gamma radiation from an atomic bomb source, March, 409

TUMORS

- See also Cancer; Sarcoma; and under names of organs and regions

- experimental observations on local tumor therapy with radionuclides (ab), Helmut B. Kanitz et al, May, 794

adenoma. See also Pituitary Body

- of colon and rectum: diagnosis and treatment in relation to cancer prevention (ab), Paul C. Morton, May, 778

angioendothelioma

- hemangioendothelioma of vagina (ab), Abraham Marck et al, May, 791

angioma. See also Telangiectasis

- radiation therapy of hemangioma (ab), P. Hess and B. Fischer, May, 791

- radiation treatment of hemangiomas (ab), Johannes Thoms and Niels Fjeldborg, May, 791

- rare manifestation of vertebral angioma (ab), Sergio Chiappa and Adolfo Sacchi, Feb., 298

- vertebral angiography in cerebellar hemangioma (ab), Olle Olsson, May, 765

- x-ray findings in Kaposi's angiomas (sarcoma idiopathica hemorrhagica multiplex) (ab), G. Bonse and R. Karg, Feb., 307

- x-ray therapy in treatment of hemangiomas (ab), Wesley W. Wilson, March, 467

chondroma

- bronchial and pulmonary hamartochondromas (ab), Paul Santy et al, Feb., 286

- calcifying enchondroma of long bones (ab), W. Laurence and E. L. Franklin, March, 462

chordoma

- chordoma—final report and re-evaluation of treatment (ab), Henry B. Orton, April, 606

- its roentgen diagnostic aspects and its response to roentgen therapy (ab), Edward J. Sennett, Feb., 299

- of lumbar vertebra (ab), Harvey W. Baker and Bradley L. Coley, Feb., 298

Ewing's

- Ewing's sarcoma: study of 50 cases treated at Massachusetts General Hospital, 1930-1952 inclusive (ab), C. C. Wang and Milford D. Schulz, Feb., 309

- experimental. See also Skin, tumors

- effects of fractionated doses of radiation on normal and tumor tissue (ab), L. C. Fogg and R. F. Cowing, Feb., 318

- protecting action of citrate on agent of chicken Tumor I (Rous sarcoma virus) during roentgen radiation in vitro (ab), W. Ray Bryan et al, May, 798

- studies with radioactive colchicine. I. Influence of tumors on tissue distribution of radioactive colchicine in mice (ab), A. Back and E. J. Walaszek, May, 796

fibroma

- intrathoracic fibroma associated with pulmonary hypertrophic osteoarthropathy; unusual case (ab), Otto Deutschberger et al, March, 446

fibromyxoma

- simultaneous occurrence of fibrous dysplasia (Jaffe-Lichtenstein) and extra-osseous fibromyxomata (ab), K. Braunschweig, March, 458

giant-cell

- of spine; 2 cases (ab), W. R. Hamsa and L. S. Campbell, Feb., 298

glioma. See Brain, tumors**hamartochondroma.** See Tumors, chondroma**hamartoma.** See also Tumors, chondroma

- cerebral calcification epilepsy; case of epilepsy caused by calcified hamartoma of brain (ab), W. Stewart Alexander, Jan., 125

hemangioma. See Tumors, angioma**hibernoma.** See Tumors, lipoma**lipoma**

- intrathoracic hibernoma; 3rd reported case (ab), J. Winthrop Peabody, Jr., et al, June, 897

- mediastinal lipoma simulating cardiac enlargement (ab), A. M. Gottlieb et al, April, 610

- of corpus callosum; case (ab), Charles D. Smith and Edgar N. Weaver, Feb., 282

- of corpus callosum; radiologic diagnosis (ab), Poul E. Andersen, June, 892

lymphoma. See also Hodgkin's Disease

- cardiac involvement in malignant lymphoma (ab), J. D. N. Nabarro, May, 792

- malignant lymphoma of stomach, I. R. Berger, Brit B. Gay, Jr., and C. M. Whorton, April, 527

- malignant lymphoma: pathology, clinical features and therapy (ab), Axel Scheel and Eivind Myhre, May, 792

mesothelioma

- solitary pleural mesotheliomas (ab), Hector W. Benoit, Jr., and Lauren V. Ackerman, Feb., 286

myoma

- calcified gastric leiomyoma; case (ab), Lowell H. Steen and W. G. Newell, March, 453

- of stomach; review of 50 cases (ab), T. Antonie, March, 453

neurinoma

- neurilemmoma of bone (ab), H. Morus Jones, May, 783

neurofibroma

- spinal meningiomas and neurofibromas (ab), J. W. D. Bull, June, 912

osteochondroma

- of bronchus (ab), Rudolph Nissen et al, March, 448

osteoclastoma

- of petrous temporal bone; case benefited by deep x-ray therapy (ab), T. A. R. Dinning, March, 468

papilloma

- of gallbladder with in situ carcinoma (ab), Edward J. Tabah and Gordon McNeer, May, 779

plasmocytoma

- primary plasma-cell tumors of upper air passages with particular reference to involvement of maxillary sinus (ab), Clyde A. Heatly, April, 631

polyp

- double contrast studies of colon: polyps in children (ab), Charles W. Yates, Feb., 294

- jejunal polyps and intussusception associated with abnormal melanin pigmentation (ab), W. Glenn Young, Jr., April, 620

TUMORS, polyposis—cont.

- melanin spots of lips, oral mucosa and digits associated with intestinal polyposis; case (ab), Lloyd F. Sherman and Robert J. Tenner, Jan., 139
- osteomatosis (leontiasis ossea): hereditary disease of membranous bone formation associated in one family with polyposis of colon, Henry P. Plenk and Eldon J. Gardner, June, 830
- sympathoblastoma**
 - thoracic sympathoblastoma simulating an intrapulmonary tumor (ab), Zdeněk V. Skokan, March, 446
- tuberculoma**. See Lungs, tuberculoma
- Wilms'.** See Kidneys, tumors
- TURNER, FRANCES M.:** An investigation into the relationship between physiologically low leucocyte counts and sickness absence (ab), June, 920
- TURNER, MARGARET L.** See GREULICH, WILLIAM W.
- TURNER, RICHARD.** See LOGAN, ANDREW
- TYPHOID FEVER**
 - radiologic aspects of small intestine (ab), E. Chérigé et al, May, 778
- TYSON, M. DAWSON.** See BOSIEN, WILLIAM R.

U

- UIHLEIN, ALFRED, and WEYAND, ROBERT D.:** Meningiomas of the anterior clinoid process as a cause of unilateral loss of vision. Surgical considerations (ab), Jan., 124
- ULCERS.** See Esophagus; Extremities; Peptic Ulcer
- ULTRAVIOLET RAYS**
 - chemical synthesis following action of physical peroxidase agents (roentgen rays, ultraviolet and ultrasonic rays) (ab), A. Lacassagne and J. Loiseleur, May, 799
- UMBAUZOENEN.** See Bones, diseases
- UMBERG, F. H.** See JOHNS, H. E.
- UMBRADIL-VISCOUS U.** See Urethra
- UMIKER, WILLIAM, and PEARCE, JOHN:** Nature and genesis of pulmonary alterations in carbon tetrachloride poisoning (ab), Jan., 131
- UNGER, S. M.:** Right-sided traumatic diaphragmatic hernia simulating a pleural effusion (ab), Jan., 140
- URETERS**
 - filling defects of ureterogram caused by varicose ureteral vein (ab), Michael H. Berman and Herbert Copeland, June, 911
- calculi**
 - appendiceal stones simulating ureteral calculi (ab), Thomas M. Sawyers and David D. Rosenfeld, June, 903
 - urological importance of radiopaque appendiceal concretions (ab), George C. Prather and James A. Singiser, March, 465

URETHRA

- relationships of female urethra and bladder in urinary stress incontinence (ab), C. P. Hodgkinson, Jan., 146
- calculi**
 - calculus: its roentgen evaluation, Paul S. Friedman, Leon Solis-Cohen and Samuel M. Joffe, Feb., 248
- diverticula
 - radiologic appearances of diverticula of male cavernous urethra (ab), Nils P. G. Edling, May, 787
- roentgenography**
 - urethrography in male: delimitation of anterior and posterior urethra, the pars diaphragmatica, the pars nuda urethrae and the presence of a musculus compressor nudaie (ab), O. Morales and R. Romanus, April, 627
 - urethrography in male with highly viscous, water-soluble contrast medium, Umbradil-Viscous U (ab), Olafio Morales and Ragnar Romanus, Feb., 303

URETHROGRAPHY. See Urethra**URINARY TRACT**

- See also Bladder; Kidneys; Pyelography; etc.
- functional roentgenology (ab), R. Seyss, June, 909
- pathology of urinary calculi: radial striation (ab), J. A. Carr, Jan., 147

URINE AND URINATION

- effect of whole-body x-irradiation on urinary B-vitamin excretion of rats (ab), W. N. Pearson et al, Feb., 319
- relationships of female urethra and bladder in urinary stress incontinence (ab), C. P. Hodgkinson, Jan., 146

UROKON. See Arteries, carotid; Extremities; Pyelography**UTERUS**

- helicoid uterus (ab), B. H. Sheares, Feb., 301
- intrauterine perforation of Meckel's diverticulum (ab), Stephen Rossa and Robert J. Gross, April, 621
- cancer**
 - cellular index of sensitivity to ionizing radiation; sensitization response (ab), Ruth M. Graham and John B. Graham, Feb., 317
 - cervical cancer: irradiation with radioactive cobalt 60 in guided aluminum needles and plastic threads (ab), Joseph L. Morton et al, March, 473
 - cervical cancer: radiation therapy from 1931-1946 (ab), N. Nicolov, May, 792
 - cervical carcinoma: an experience with surgical treatment (ab), Joe V. Meigs, March, 470
 - cervical carcinoma: effect of therapeutic irradiation on liver function (ab), J. R. Snavey et al, May, 797
 - cervical carcinoma: is the 5-year cure a permanent cure? Contribution to the problem of control (ab), H. Reichenmiller and H. Drescher, March, 470
 - cervical carcinoma: management (ab), Jesshill Love et al, April, 634

- cervical carcinoma: optimum dosage studies for radiation therapy, James F. Nolan and Lucille DuSault, June, 862
- cervical carcinoma; radioactive colloidal gold in (ab), S. D. Soule, April, 637
- cervical carcinoma: results of radiation therapy at I. Gynecological Clinic of University of Munich in 1945 and 1946 (ab), Heinrich Eymmer and Julius Ries, March, 470
- cervical carcinoma: study of renal tract (ab), Ruth Dearing, Feb., 305
- cervical carcinoma: use of radioactive isotopes in applicator for treatment (ab), Robert C. Tudway, March, 472
- cervical carcinoma: value of serial biopsies following irradiation (ab), K. A. McGarrity, March, 471
- combined surgery and irradiation in treatment of cancer of cervical stump (ab), Henry A. Young and August F. Jonas, Jan., 152
- Furacin vaginal suppositories: their use with radiation therapy for malignant pelvic neoplasms (ab), Jerome Schwartz and Vincent Nardiello, March, 471
- post-irradiative prophylactic extraperitoneal lymphadenectomy in carcinoma of uterine cervix (ab), Gunnar Gorton, Jan., 151
- production of ACTH in patient undergoing gynecologic surgery or receiving pelvic irradiation (ab), Allan C. Barnes, Feb., 318
- recurrences after treatment of malignant tumors of female genitalia (ab), H. Czech and R. K. Kepp, Jan., 153
- treatment of cervical stump carcinoma (ab), Galen M. Tice, Jan., 152
- cervix.** See also Uterus, cancer
- habitual abortion: a radiographic technic to demonstrate internal os of cervix (ab), Frank E. Rubovits et al, May, 785
- hemorrhage**
 - radiotherapy of benign bleeding (ab), Hans-Joachim Fiebelkorn, Jan., 154
- roentgenography**
 - See also Fallopian Tubes
 - intrauterine roentgenography as aid in determining fetal age; preliminary report (ab), Theodore W. Adams et al, June, 907
 - x-ray diagnosis of uterine pathology (ab), Arthur M. Davids, April, 625
- UVEITIS**
 - roentgen irradiation: clinical and experimental results (ab), Carl Fried, March, 471
- UYEYAMA, KAHN.** See ROWE, ALBERT H.

V**VAGINA**

- Furacin vaginal suppositories: their use with radiation therapy for malignant pelvic neoplasms (ab), Jerome Schwartz and Vincent Nardiello, March, 471
- hemangioidothelioma (ab), Abraham Marck et al, May, 791

VANCE, CHARLES A. See STRODE, ERNEST C.**VAN CLEAVE, C. D., and KAYLOR, C. T.:** Distribution and retention of carrier-free radioberyllium in the rat (ab), March, 475**VANDIVERT, V. V.** See SKOW, R. K.**van DOORN-WITKAMPF, H. van W.** See BOTHWELL, T. H.**VAN DYKE, JAMES G.** See GOULD, S. E.**VAN EPPS, EUGENE F.:** Agenesis of the corpus callosum with concomitant malformations, including agenesis of the foramina of Luschka and Magendie (ab), May, 765**VAN HORN, PHILIP S.** See JACOBS, LEWIS G.**VAN WYK, JUDSON J.** See BAXTER, JAMES H.**VARICOSE VEINS.** See Veins, uterine**VARIX.** See Esophagus**VASOGRAPHY.** See Extremities**VATER'S AMPULLA**

- pancreatic, ductal, and vaterian neoplasms: their roentgen manifestations, Philip J. Hodes, Eugene P. Pendergrass and Norman J. Winston, Jan., 1

VEINS

- arteriovenous anastomoses as seen in x-ray film (ab), E. Vogler, Jan., 148
- cerebral.** See Brain, blood supply; Brain, tumors
- orbital.** See Orbit
- pulmonary**
 - persistent left superior vena cava draining pulmonary veins (ab), Frances Gardner and Samuel Oram, April, 615
 - tomographic study of pulmonary veins in mitral disease (ab), J. Moniz de Bettencourt et al, April, 615
- splenic.** See Spleen; Thrombosis, splenic
- subclavian**
 - obstruction; case studied by venography and relieved by surgery (ab), Orville Horwitz and Harry F. Zinsser, Jr., Jan., 149
- ureteral**
 - filling defects of ureterogram caused by varicose ureteral vein (ab), Michael H. Berman and Herbert Copeland, June, 911
- VENAE CAVAE**
 - caval reflexes in angiocardiology and the dynamics of right atrium (ab), Christian Hedman et al, Feb., 290
 - persistent left superior vena cava draining pulmonary veins (ab), Frances Gardner and Samuel Oram, April, 615
- VENOGRAPHY.** See Extremities; Portal Vein; Veins; etc.

- VENTRICULOGRAPHY.** See Aqueduct of Sylvius; Brain, roentgenography
- VERRUCA**
—treatment of plantar warts (ab), Rud. Koch, May, 793
- VERSPYCK, R.** See CHÉRIGIÉ, E.
- VESICULOGRAPHY.** See Seminal Vesicles
- VÉŠIN, SLAVOJ:** Roentgenologic symptomatology of diaphragmatic tumors (ab), March, 450
- VEST, SAMUEL A.** See BOYCE, WILLIAM H.
- VICKERY, AUSTIN L.** See DOBYNS, BROWN M.
- VILLAGORDA, GUILLERMO.** See MOROS G., GUSTAVO
- VISCERA**
—Kartagener's triad; 2 cases, T. A. Gross, March, 347
- VISION.** See Eyes; Glasses
- VISSCHER, FRANK.** See HAMMER, JOHN M.
- VITAMINS**
B
—effect of whole-body x-irradiation on urinary B-vitamin excretion of rats (ab), W. N. Pearson et al, Feb., 319
- D
—comparative study of reaction to injury. II. Hypervitaminosis D in frog with special reference to lime sacs (ab), Hans Schlumberger and Donald H. Burk, June, 906
- vitamin D poisoning with metastatic calcification; report of case and review of mechanism of intoxication (ab), Charles W. Wilson et al, Jan., 141
- VLAD, PETER.** See KEITH, J. D.
- See ROWE, R. D.
- VOGLER, E.:** Arteriovenous anastomoses as seen in the x-ray film (ab), Jan., 148
- Vasographic contribution to the etiology and genesis of the crural ulcer (ab), May, 788
- VOLVULUS.** See Intestines, volvulus; Lungs; Stomach
- VOORHOEVE'S DISEASE.** See Osteosclerosis fragilis

W

- WAISMAN, HARRY A., and HARVEY, ROGER A.:** Radiological evidence of growth in children with acute leukemia treated with folic acid antagonists, Jan., 61
- WALASZEK, E. J.** See BACK, A.
- WALK, L.:** Diagnostic lumbar disk puncture. Clinical review and analysis of sixty-seven cases (ab), Jan., 142
- WALKER, J. FRANK.** See COLVIN, E. M.
- WALKER, R. MILNES.** See NANSON, E. M.
- WALLACE, D. M.** See POCHIN, E. E.
- WALTER, J.:** Radioactive gold in malignant effusions (ab) April, 637
- WALTON, R. J.** See POCHIN, E. E.
- WANG, C. C., and SCHULZ, MILFORD D.:** Ewing's sarcoma. A study of fifty cases treated at the Massachusetts General Hospital, 1930-1952 inclusive (ab), Feb., 309
- WARREN, KENNETH W.:** Tumors of the carotid body: recognition and treatment (ab), April, 632
- WARRICK, C. K., and BRENNER, A. E.:** Fractures of the calcaneum, with an atlas illustrating the various types of fracture (ab), Jan., 145
- WARSHAW, LESLEY M.** See LAWRENCE, WALTER, Jr.
- WARTHIN, THOMAS A., ROSS, FREDERICK P., BAKER, DONALD V., and WISSING, EGON:** The management of upper gastrointestinal hemorrhage (ab), June, 899
- WARTS.** See Verruca
- WATER**
—experimental acute radiodermatitis. III. Changes in water, fat, and protein content (in skin) (ab), C. C. Lushbaugh and D. B. Hale, June, 919
- WATKINS, WILLIAM M.** See OLNICK, HERBERT M.
- WATROUS, R. M., HODGES, HAZEL W., and McANDREW, M. J.:** Radiation burns from diffraction apparatus simulating infections. Report of cases (ab), April, 638
- WATSON, T. A., JOHNS, H. E., and BURKELL, C. C.:** The Saskatchewan 1,000-curie cobalt 60 unit, Feb., 165
- See FEDORUK, S. O.
- See JOHNS, H. E.
- WEAR, JOHN M.** See BAYLIN, GEORGE J.
- WEAVER, EDGAR N.** See SMITH, CHARLES D.
- WEBER, H. W., and LOHR, B.:** Clinical findings and anatomical changes in the lungs following bronchography with Perabrodil BR (viscosity 60 per cent) (ab), June, 894
- WEBSTER, J. E.** See MARTIN, F. A.
- WEENS, H. STEPHEN, CLEMENTS, J. LUTHER, and TOLAN, JOHN H.:** Radiation dosage to the female genital tract during fluoroscopic procedures, May, 745
- WEGELIUS, CARL, and LIND, JOHN:** The role of the exposure rate in angiocardiology (ab), Jan., 134
- See HEDMAN, CHRISTIAN
- See LIND, JOHN
- WEINER, JEROME J., and LaCORTE, SAMUEL:** Benign non-traumatic stricture of the left intrahepatic bile duct (ab), May, 784
- WEINSTEIN, MANDEL, and ROBERTS, MORTON:** Leiomyosarcoma of the duodenum. Report of a case and summary of the literature (ab), Jan., 138
- WEINSTEIN, VERNON A.** See COLP, RALPH
- WEISSEL, WILSON, and LANDIS, FRANCIS B.:** Endobronchial lesions in pulmonary blastomycosis (ab), April, 609
- WEISS, HOWARD.** See GASUL, BENJAMIN M.
- WEISS, WILLIAM, BOUCOT, KATHARINE R., and GEFTER, WILLIAM I.:** Localized interlobar effusion in congestive heart failure (ab), April, 612
- WELDERS**
—respiratory disorders among welders (ab), Robert Charr, May, 770
- WELIN, SÖLVE:** Roentgenologic diagnosis and follow-up of hypopharyngeal cancer (ab), March, 468
- WERBELOFF, L., and MERSEY, C.:** Gastro-esophageal regurgitation: its incidence and relation to symptoms (ab), June, 900
- WERMER, PAUL, KUSCHNER, MARVIN, and RILEY, EDGAR A.:** Reversible metastatic calcification associated with excessive milk and alkali intake (ab), Jan., 141
- WERNER, K.:** Contribution to Besnier-Boeck-Schaumann disease (ab), June, 897
- Control of radiation sickness with dihydroergotamine (ab), March, 475
- WESSLER, STANFORD, and SCHLESINGER, MONROE J.:** Studies in peripheral arterial occlusive disease. I. Methods and pathologic findings in amputated limbs (ab), March, 465
- WEST, JAMES HUBERT (obit),** March, 434
- WEST, JOHN P.:** Obstruction of the proximal jejunum following gastric resection and antecolic anastomosis. Report on three cases (ab), May, 777
- and FLOYD, VANN T.: Volvulus of the stomach (ab), May, 774
- SCHETLIN, CHARLES F., and SCHILLING, FREDERICK J.: Thrombosis of the abdominal aorta treated by thromboendarterectomy. A case report (ab), May, 787
- WEST, R.:** Isotope handling calculator (ab), June, 918
- WEYAND, ROBERT D.** See UHLEIN, ALFRED
- WHEATCROFT, M. G., and MORGAN, J. E.:** Absorption of x-rays by tissues of the head and neck, March, 423
- WHEELER, H. BROWNELL.** See BOTSFORD, THOMAS W.
- WHIMSTER, W. S.** See MACGREGOR, ALASTAIR G.
- WHITAKER, THOMAS E., Jr.** See BERSACK, SOLOMON R.
- WHITE, JAMES C.** See BAKAY, LOUIS
- WHITE, WILLIAM E.:** The rate of formation of nondiffusible (organic) fraction of I^{131} in plasma correlated with apparent thyroid state (ab), Feb., 314
- WHITEHEAD, A. S.:** Determination of the placental site by soft-tissue radiography (ab), Feb., 301
- Placentography. Symposium. IV. Diagnosis of placenta praevia by soft tissue radiography (ab), June, 908
- WHITELEY, JAMES M.** See ADAMS, THEODORE W.
- WHITESIDE, C. G.** See NURICK, A. W.
- WHITMORE, G. F.** See JOHNS, H. E.
- WHORTON, C. M.** See BERGER, I. R.
- WHYTE, G. N.** See GHOSH, A.
- WICKBOM, INGMAR, and SHELDON, PHILIP:** Some aspects of the radiologic diagnosis of posterior fossa and supra-sellar tumours (ab), June, 893
- See SHELDON, P. W. E.
- WILDER, THOMAS C.** See TOBIN, JOHN R., Jr.
- WILDING, JAMES L.** See RUST, JOHN H.
- WILKINSON, G. W., and LEBLOND, C. P.:** The deposition of radiophosphorus in fractured bones in rats (ab), June, 917
- WILLMANN, K.-H.:** The pulmonary tuberculosis (ab), Jan., 129
- WILLNER, OLOF:** A time-marker for urograms (ab), April, 631
- WILLSON, JAMES K. V.** See DAVIDSON, CHARLES N.
- WILMS' TUMOR.** See Kidneys, tumors
- WILSON, BEN.** See REID, ALLEN F.
- WILSON, CHARLES W., WINGFIELD, WILLIAM L., and TOONE, ELAM C., Jr.:** Vitamin D poisoning with metastatic calcification. Report of a case and review of the mechanism of intoxication (ab), Jan., 141
- WILSON, FRANCIS W.:** An understanding of prolapsed gastric mucosa (ab), Jan., 138
- WILSON, HUGH M.:** Roentgenological aspects of renal function (ab), Feb., 304
- See MARDER, SUMNER N.
- WILSON, JAMES E.** See THOMSON, JOHN F.
- WILSON, M. E., and STOWELL, R. E.:** Cytological changes following roentgen irradiation of the liver in mice (ab), Feb., 318
- WILSON, McCLURE.** See STEVENSON, CLYDE A.
- WILSON, RICHARD G., MINTNER, DONALD W., and HAYES, J. DUTNEY:** Report of a case of eosinophilic granuloma of bone with roentgenographic demonstration of a sequestrum (ab), April, 623
- WILSON, WESLEY W.:** X-ray therapy in the treatment of hemangiomas (ab), March, 467
- WINGFIELD, WILLIAM L.** See WILSON, CHARLES W.
- WINGUTH, H.** See GOMBERT, H. J.
- WINSBURY-WHITE, H. P.:** Treatment of carcinoma of the bladder (ab), Feb., 309
- WINSTON, NORMAN J.** See HODES, PHILIP J.
- WIRTHWEIN, CARLTON.** See MARCK, ABRAHAM
- WIRTS, C. WILMER.** See CHAIKEN, BERNARD H.
- WIRZ, F.:** Osteoporosis as an early symptom of osteochondrosis deformans coxae juvenilis (Perthes) (ab), Feb., 299
- WISHAM, LAWRENCE H.** See FREUND, JACK
- WISSING, EGON.** See WARTHIN, THOMAS A.
- WITTE, ERNST:** Experimental studies on the effect of ionizing radiation delivered intermittently (ab), Jan., 161
- WITTENBERG, MARTIN H.** See NADAS, ALEXANDER S.
- See NEUHAUSER, EDWARD B. D.
- WIUM, PETER P.** See ERSKINE, JOHN P.
- WOLINSKY, EMANUEL.** See STEENKEN, WILLIAM, Jr.
- WOLKIN, ABRAHAM:** The significance of calcification in the ascending portion of the aortic arch, Jan., 101
- WOLL, EPHRAIM.** See FOLEY, JOSEPH C.

- WOODRUFF, LOIS A. See LOONEY, WILLIAM B.
 WOODS, M. C., GAMBLE, FRANCES N., FURTH, J., and
 BIGELOW, R. R.: Control of the postirradiation hem-
 orrhagic state by platelet transfusions (ab), April, 639
 WORRELL, HOWARD E. See SENNOTT, WALDRON M.
 WORTH, G., and HEINZ, W.: Changes in the bronchi in sili-
 cosis and silicotuberculosis (ab), Jan., 128

WOUNDS

- See also Trauma
 —roentgen rays and wound healing; experimental study
 (ab), Walter Lawrence, Jr., et al, Jan., 162

WRIGHT, KENNETH A. See TRUMP, JOHN G.

WRIST

- See also Scaphoid Bone, Carpal
 —occurrence of bipartite os radiale dorsale: previously unre-
 ported accessory bones of radiocarpal joint (ab), A. Rösli,
 June, 907
 —rare dislocations and fracture-dislocations (ab), H. Fietz,
 March, 459
 —survey of carpal and tarsal anomalies (ab), Ronan O'Ra-
 hilly, May, 784

WUHRMANN, F., and JASIŃSKI, B.: Investigations to deter-
 mine the union of iron with beta globulin and its clinical
 significance with the aid of Fe⁵⁹ (ab), June, 917

WYBOURN, ROBERT C. See SCHNEIDER, MARTIN

WYCIS, HENRY. See LIN, PAUL

WYMAN, ALVIN C.: Roentgenologic diagnosis of traumatic
 rupture of the thoracic aorta (ab), March, 449

WYMAN, STANLEY M.: Congenital absence of a pulmonary
 artery: its demonstration by roentgenography, March,
 321

—See ROBBINS, LAURENCE L.

X

XANTHOGRANULOMA. See Xanthoma

XANTHOMA

- xanthogranulomatous disease of bone with polyarthritis;
 2 cases (ab), G. N. Golden and H. G. H. Richards, March,
 457

Y

YALOW, ROSALYN S. See FREUND, JACK

YAMASOWA, YOSHIMICHI: Hematologic studies of irradi-
 ated survivors in Hiroshima, Japan (ab), Jan., 159

YARNIS, HARRY. See MARSHAK, RICHARD H.

YATES, CHARLES W.: Double contrast studies of the colon:
 polyps in children (ab), Feb., 294

YATES, T. M.: Distortion of pyelogram by extrarenal lesion:
 liver abscess distortion of pyelogram (ab), Jan., 147

YERUSHALMY, J.: The reliability of chest roentgenography
 and its clinical implications (ab), June, 806

YOUNG, HENRY A., and JONAS, AUGUST F.: Combined
 surgery and irradiation in the treatment of cancer of the
 cervical stump (ab), Jan., 152

YOUNG, W. GLENN, Jr.: Jejunal polyps and intussusception
 associated with abnormal melanin pigmentation (ab),
 April, 620

YOUTCHEFF, ELSIE. See BAUER, FRANZ K.

YUHL, ERIC T., STIRRETT, LLOYD A., and CASSEN, BENE-
 DICT: Use of colloidal Au¹⁹⁸ for obtaining scintigrams of
 the liver (ab), Feb., 315

—See STIRRETT, LLOYD A.

Z

ZDANSKY, E., DREXLER, L., and HAMPEL, K.: The tannin
 enema in inflammatory conditions of the colon (ab), June,
 903

ZIEDSES des PLANTES, B. G.: Ventriculography with small
 amounts of air (ab), June, 888

ZIMMERMAN, JACOB, GROW, JOHN B., and HURST, AL-
 LAN: An evaluation of extrapleural pneumonolysis based
 on a follow-up study of seventy cases with Lucite plomb-
 age (ab), March, 447

ZINGG, WALTER, and PERRY, WILLIAM F.: Influence of
 adrenal and gonadal steroids on the uptake of iodine by
 the thyroid gland (ab), April, 636

ZINN, W. BERKELEY: Body-section radiographic equipment:
 modifications and accessories, March, 416

ZINSSER, HARRY F., Jr. See HORWITZ, ORVILLE

ZISKIND, JOSEPH. See PEABODY, J. WINTHROP, Jr.

ZOLLINGER, H. U., and FISCHER, F. K.: Further empirical
 and experimental studies with Joduron bronchography
 (ab), June, 893

ZUPPINGER, A., and LÄSER, S.: Roentgen examination of the
 stomach with special consideration of the diagnosis of
 cancer (ab), June, 901

